

(2) FG

The Development of American Tank Destroyers During World War II:
the Impact of Doctrine, Combat Experience, and Technology on Materiel
Acquisition.

Charles M. Baily, CPT, USA
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas 66027

ADA 028974

Final report, 11 June 1976

Approved for public release; distribution unlimited.

A Master of Military Art and Science thesis presented to the faculty of
the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas
66027

7260
102

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The Development of American Tank Destroyers During World War II: the Impact of Doctrine, Combat Experience, and Technology on Materiel Acquisition		5. TYPE OF REPORT & PERIOD COVERED Final Report 11 Jun 76
7. AUTHOR(s) Baily, Charles M., CPT, USA		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Student at the U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Command and General Staff College ATTN: ATSW-SE		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 11 Jun 76
		13. NUMBER OF PAGES 136
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Master of Military Art and Science (MMAS) Thesis prepared at CGSC in partial fulfillment of the Masters Program requirements, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas 66027		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The success of Germany's armored formations during the early years of World War II forced the US Army to reexamine the problem of antitank warfare. The result of that reexamination was a uniquely American solution—the tank destroyers. Primarily the brainchild of General Lesley J. McNair, the doctrine of tank destroyers was based on the concept of mobile antitank guns, organized in battalions, which could move and mass as necessary to defeat enemy tanks.		

(Block 20)

By early 1942, the US Army had developed organizations and detailed doctrine to implement General McNair's concepts. However, an intrinsic problem, developing equipment for the units, had yet to be solved.

This study focuses on the development of guns and gun motor carriages for the tank destroyers. The Tank Destroyer Center used a twofold approach to solve its equipment problems: first, adapt what was immediately available as expedient equipment, and, second, begin development of an ideal tank destroyer designed to fit their doctrine. Circumstances forced the US Army to thrust its tank destroyers into combat before the ideal tank destroyer was available.

The tank destroyers in combat theaters were never employed according to their doctrine. Misemployment and the limitations of expedient equipment created dissatisfaction among overseas commanders concerning tank destroyers. Pressure from overseas effected doctrine, organization, and development efforts in the United States. The US Army forced the Tank Destroyer Center to adopt and develop weapons unsuitable, in the latter's view, for tank destroyer doctrine—towed guns.

A technological threat from heavy German tanks caused development efforts in the United States to incorporate bigger guns. The US Army's failure to properly assess the magnitude of the threat resulted in a scarcity of adequate antitank weapons in Northwest Europe. When the ideal tank destroyer, the M-18 "Hellcat," finally reached Europe; it proved to be undergunned.

The study concludes that the development of equipment is not strictly a technological process. Doctrine and combat experience alter the path of development. Personalities and the pressure of war accentuate different views and also effect development. Technology dictates the speed of creating new equipment demanded by doctrine and combat experience.

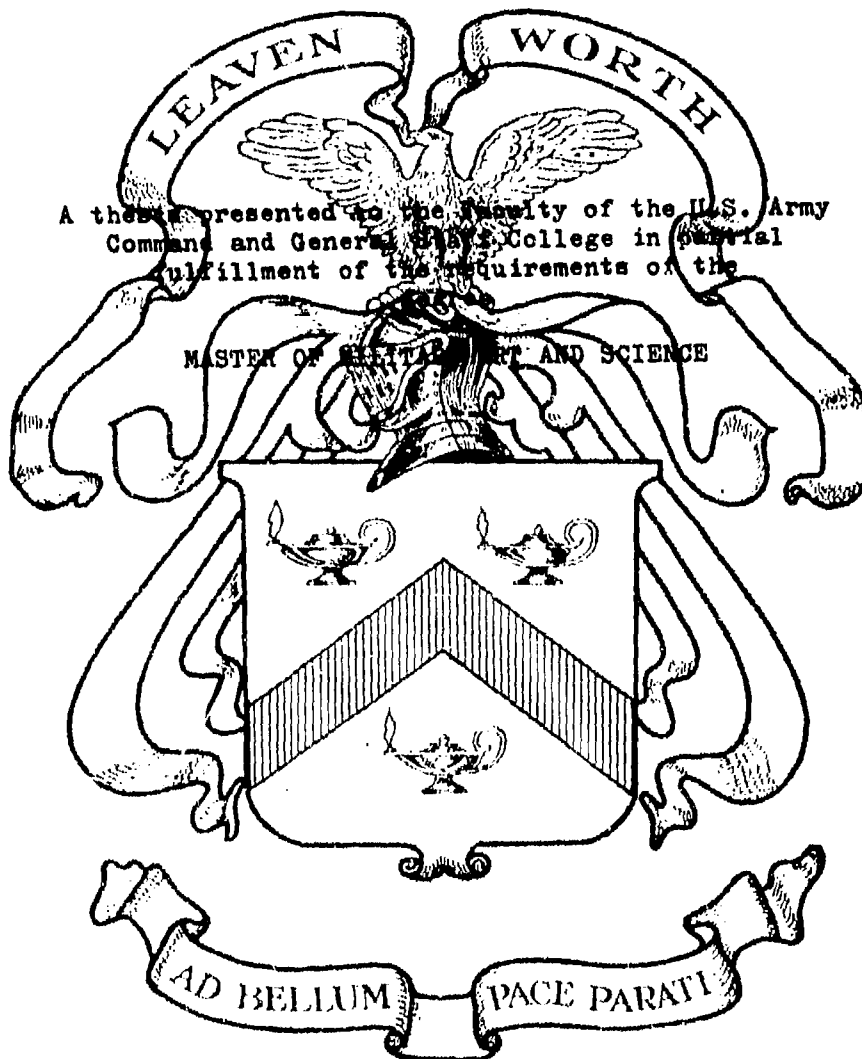
THE DEVELOPMENT OF AMERICAN TANK DESTROYERS DURING WORLD WAR II:

THE IMPACT OF DOCTRINE, COMBAT EXPERIENCE, AND

TECHNOLOGY ON MATERIEL ACQUISITION

A thesis presented to the faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements of the

MASTER OF MILITARY ART AND SCIENCE



Fort Leavenworth, Kansas
1976

THE DEVELOPMENT OF AMERICAN TANK DESTROYERS DURING WORLD WAR II:
THE IMPACT OF DOCTRINE, COMBAT EXPERIENCE, AND
TECHNOLOGY ON MATERIEL ACQUISITION

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements of the
degree

MASTER OF MILITARY ART AND SCIENCE

by

C. M. BAILY, CPT, USA
B.S., United States Military Academy, 1966
M.A., Duke University, 1975

Fort Leavenworth, Kansas
1976

NTIS		World Section	<input checked="" type="checkbox"/>
DGS		Staff Section	<input type="checkbox"/>
UNANNOUNCED			<input type="checkbox"/>
JANUARY 1976			
BY DISTRIBUTION/AVAILABILITY CODES			
DISC.	AVAIL.	and/or	SPECIAL
A			

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of candidate CHARLES M. BAILY

Title of thesis The Development of American Tank Destroyers During
World War II: the Impact of Doctrine, Combat Experience, and
Technology on Materiel Acquisition

Approved by:

William P. Kathol Research Advisor

Frederick W. Sawyer Member, Graduate Research Faculty

J. H. [unclear] Member, Graduate Research Faculty

Accepted this 13th day of May 1976 by *John B. [unclear]*,
Director, Master of Military Art and Science.

The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

The success of Germany's armored formations during the early years of World War II forced the US Army to reexamine the problem of antitank warfare. The result of that reexamination was a uniquely American solution--the tank destroyers.

Primarily the brainchild of General Lesley J. McNair, the doctrine of tank destroyers was based on the concept of mobile antitank guns, organized in battalions, which could move and mass as necessary to defeat enemy tanks. By early 1942, the US Army had developed organizations and detailed doctrine to implement General McNair's concepts. However, an intrinsic problem, developing equipment for the units, had yet to be solved.

This study focuses on the development of guns and gun motor carriages for the tank destroyers. The Tank Destroyer Center used a twofold approach to solve its equipment problems: first, adapt what was immediately available as expedient equipment, and, second, begin development of an ideal tank destroyer designed to fit their doctrine. Circumstances forced the US Army to thrust its tank destroyers into combat before the ideal tank destroyer was available.

The tank destroyers in combat theaters were never employed according to their doctrine. Misemployment and the limitations of expedient equipment created dissatisfaction among overseas commanders concerning tank destroyers. Pressure from overseas effected

doctrine, organization, and development efforts in the United States. The US Army forced the Tank Destroyer Center to adopt and develop weapons unsuitable, in the latter's view, for tank destroyer doctrine---towed guns.

A technological threat from heavy German tanks caused development efforts in the United States to incorporate bigger guns. The US Army's failure to properly assess the magnitude of the threat resulted in a scarcity of adequate antitank weapons in Northwest Europe. When the ideal tank destroyer, the M-18 "Hellcat," finally reached Europe, it proved to be undergunned.

The study concludes that the development of equipment is not strictly a technological process. Doctrine and combat experience alter the path of development. Personalities and the pressure of war accentuate different views and also effect development. Technology dictates the speed of creating new equipment demanded by doctrine and combat experience.

TABLE OF CONTENTS

	Page
THESIS APPROVAL PAGE	ii
ABSTRACT	iii
INTRODUCTION	1
CHAPTER	
1. CREATING DOCTRINE	6
2. DEVELOPING EQUIPMENT, 1940--1942	27
3. COMBAT IN NORTH AFRICA	48
4. DOCTRINE AND DEVELOPMENT, 1943--1944	64
5. COMBAT IN NORTHWEST EUROPE	90
CONCLUSION	112
APPENDIX	122
MAPS	128
BIBLIOGRAPHY	133

INTRODUCTION

"Stopping enemy tanks and other mechanized vehicles is the biggest job confronting our Army today."¹ Thus, Brigadier General Henry L. Twaddle, Assistant Chief of Staff, G3, War Department, expressed his own sentiments and the attitude of many other officers in the summer of 1941. America's impending involvement in the war in Europe forced the Army's leaders to consider methods for countering a new, potent threat--the German Panzer Divisions.

The antitank defenses of Germany's adversaries had been generally similar. In essence, each division possessed an allocation of antitank guns that were dispersed among the divisions' units.² In considering the antitank systems that had opposed Germany during the first years of war, only one thing was clear--all had failed.

The most influential event to the military leaders in the United States had been the fall of France. Prior to World War II, the French Army was probably the most respected in Europe. After a winter of "phony war," France was crushed in a month's time. Although there were many reasons for the defeat of France, an important one was that French antitank defenses had not stopped German tanks.

Lack of a successful European model induced the US Army to create a new, uniquely American system for antitank defense--tank destroyers. The American concept, which committed the bulk of

antitank assets to semi-independent battalions that were assigned to a force pool, was not duplicated in any other army. In general, the solution used by other armies was twofold: first, increasing the size and effectiveness of antitank guns, and, second, increasing the number of antitank guns throughout their force structures. Essentially, foreign armies reacted to the threat of tanks by increasing antitank firepower.³ In contrast, the United States developed a defined doctrine to counter tanks and created special organizations to implement the doctrine. While other nations had antitank organizations, those units reinforced or were organic to divisions; and divisions fought the antiarmor battle. American doctrine visualized fighting tanks behind the divisions with units under corps or army control. The American Army had to initiate major development programs to build equipment for the new units.

Like the tank destroyer battalions, American gun motor carriages, which were popularly called tank destroyers or TD's, were unique to the US Army. Designed to fit a specific doctrine, the fast, turreted, lightly armored tank destroyers of the United States had no foreign counterparts. The European armies merely reacted to the necessity of providing mobility and armor protection to increasingly heavy antitank guns. The British specialized in mounting antitank guns on trucks, while the German Army favored the modification of existing, often obsolete, tank chassis to carry the largest gun possible. Russian efforts mimicked the Germans. The visible differences between the tank destroyers and the German or Russian self-propelled guns reflected opposing views concerning tactics.⁴ However, the development of America's specialized

vehicles proved to be more difficult than the German or Russian ventures which were straightforward adaptations that sacrificed traverse for the capability to carry bigger guns. Developing the desired gun motor carriages proved to be the biggest obstacle involved in creating the tank destroyers.

The primary focus of this study will be the development of guns and gun motor carriages for the US tank destroyer battalions. The development of tank destroyers, whose requirement was generated by a defined tactical doctrine, offers a case study of the process of producing military equipment. The checkered career of tank destroyers exposes most of the factors that effect the development of major items of military hardware.

Superficially, the development of equipment is a very straightforward process. Given a broad set of requirements that are dictated by tactical doctrine, engineers put together various components to arrive at a piece of equipment that satisfies the requirements. However, even this idyllic process is time consuming. All the necessary components are rarely lying on a shelf. Human errors in design complicate the entire procedure. The complete development cycle for a major piece of equipment takes years, and this was true for tank destroyers.

While the tank destroyer units waited for the desired equipment, they were forced to go to war with expedients. Since their equipment could not meet the demands of tank destroyer doctrine, the doctrine had to be modified. Just as tactics have always been changed to take advantage of new military technology, tactics must allow for deficiencies of technology.

The test of combat affected both doctrine and equipment. The limitations of the first tank destroyers forced the adoption of equipment unsuited to tank destroyer doctrine—towed antitank guns. This started a new path of development, and doctrine had to be bent to accommodate the new weapon.

In addition, changes in foreign technology and doctrine posed new realities for the tank destroyers. The tank destroyers rarely faced the enemy that they were designed to meet (massive armored attacks), because the big German tank formations were severely eroded in Russia. Meanwhile, the Germans began piling heavier armor on their tanks, and technical intelligence failed to expose the true dimensions of this new threat. The tank destroyers were forced to adopt far heavier weapons than those envisaged in 1941 in order to combat the heavy German armor.

The move toward heavier guns played a large part in the ultimate demise of the tank destroyers. The mobility of the towed guns shrank drastically as their size grew. Gun motor carriages also grew and became, in effect, hybrid tanks. Finally, as tanks were equipped with heavier guns, the advantage in firepower that the tank destroyer had held was erased. After World War II, tank destroyers were abandoned.

In summation, the thesis of this study is that the development of tank destroyer equipment during World War II was a dynamic process that combined technology, doctrine, and combat experience. Personalities affected all phases of development. Finally, the events were focused and compressed by the pressure of war.

ENDNOTES

¹"Notes on G-3, Anti-tank Conference, July 14-20, 1941, War College, Washington, D.C." (hereafter cited as AT Conf.), Andrew D. Bruce Papers, Archives, US Army Military History Research Collection, p. 7, hereafter cited as Bruce.

²Daniel Vilfroy, War in the West (Harrisburg, PA: Military Service Publishing Co., 1942), p. 22 mentions France's antitank organization, but Robert A. Doughty, French Antitank Doctrine, 1940: The Antidote that Failed (a manuscript which the author expects to see published in Military Review, May 1976) provides a much-needed analysis of the topic. Lionel F. Ellis, The War in France and Flanders: 1939-1940 (London: H. M. Stationery Office, 1953), p. 371 and Victory in the West (London: H. M. Stationery Office, 1962), p. 539, briefly describes the antitank organizations of England. W. J. K. Davies, German Army Handbook (New York: Arco Publishing Company, Inc., 1974), pp. 28-52. While the German Army did have some independent, antitank battalions, these were used to reinforce divisions with heavy, scarce equipment which the divisions did not have. Of course, the German situation is complicated by the fact that some of the best antitank weapons were in Flak (Air Force) units.

³Ibid., and Peter Chamberlain and Terry Gander, Anti-Tank Weapons: WW 2 Fact Files (New York: Arco Publishing Co., 1974), pp. 1-2, 6-20, 38-42, 47-50, and 53-57.

⁴Peter Chamberlain and Terry Gander, Self-Propelled Anti-Tank and Anti-Aircraft Guns (New York: Arco Publishing Co., 1975), pp. 9-25, 41-44, 50-58, and 59-64.

CHAPTER 1

CREATING DOCTRINE

Although the lifespan of the tank destroyers covered only the years of World War II, the ideas that generated them began well before America's involvement in that conflict. If there was a "father" of the tank destroyer, such a title would have to belong to General Lesley J. McNair.¹ The broad outlines of the tank destroyer formations had crystalized in General McNair's mind by 1940. General McNair's successive duties as Commandant of the US Army Command and General Staff School, Chief of Staff of the General Headquarters, and Commander of Army Ground Forces (AGF) placed him in an unmatched position to influence the organization and doctrine of America's land army.

Although it is impossible to select a precise date for the birth of the tank destroyer in McNair's thinking, there are indications that the idea had begun to form by 1939. During that year, while General McNair was Commandant, the officers of the US Army Command and General Staff School studied the problem of antiarmor defense. One product of their efforts was a text, Antimechanized Defense.² It can be assumed that General McNair concurred with and probably influenced the text.

The thinking at Fort Leavenworth was that antitank units must concentrate into an organized defense to meet an attack by a large number of tanks. As the text of Antimechanized Defense states:

A few tanks can be combated by a few antitank guns. On the other hand an organized tank attack must be met by a well organized antitank gun defense which will normally employ complete units . . . an organized attack calls for the concentration of strong antitank forces

The statement above was somewhat at odds with the antitank organization of the time. Antitank weapons were dispersed within regiments or battalions. Clearly, the concentration envisaged by the officers at Fort Leavenworth was not well supported by existing organization. Concentration would be easier if all divisions' antitank assets were concentrated in a single unit.

Although the text written at Fort Leavenworth was intended only for antimechanized defense within the infantry division, its ideas could be logically extended to larger formations. If a tank attack was large enough to be a corps problem, it followed that the corps' antitank assets should be concentrated. The idea of concentrating antitank units on a large scale did not escape General McNair.

By 1940 General McNair's thoughts on defeating enemy armor had crystallized into a relatively well-defined concept that ultimately led to the tank destroyer units. However, by that time a major controversy had developed in the Army concerning the best means of countering enemy tanks.

There were essentially two conflicting positions. One, in agreement with General McNair's ideas, held that the best defense against tanks was to improve the efficiency of antitank measures. The opposing idea was that enemy tanks could be stopped by friendly armor formations.

In July 1940 Major General George A. Lynch, Chief of

Infantry, advised the adoption of the latter proposition to the G3 of the War Department. Lynch argued that antitank guns, due to their vulnerability while moving, could only be used to oppose the initial attack of armored forces and were useless if the enemy force achieved a breakthrough. He concluded that "The best antitank defense lies in the defeat of hostile armored forces by our own armored units." According to Lynch, the French had failed because they lacked effective mobile units, and " . . . antitank guns proved inadequate to meet a breakthrough, even against the most lightly armored tanks."⁴

General McNair's response to the Chief of Infantry's memo clearly explained his ideas concerning antitank defense. "It is believed," commented General McNair, "that the European war to date has supplied no conclusive lessons as to antitank defense, other than that it has been inadequate." Further, General McNair pointed out that during tests of the triangular division in 1937, antitank units proved to have mobility equal to armor units. He contended that:

Antitank guns must be organized and "multiplied" so as to permit their timely concentration in numbers commensurate with the strength of the hostile tank attack. Their organic assignment to divisions and similar units tends to prevent their concentration when and where needed, and subjects us to the inevitable consequences of dispersion. An antitank gun is cheaper than a tank. Providing antitank guns in fully adequate numbers is a waste of resources only in case such guns are dispersed so widely as to be effective nowhere [Anti-tank] guns should be organized in tactically self-sufficient battalions, each complete with warning communications . . . this number of guns should constitute a mobile GHQ reserve, available for meeting major masses of tanks.⁵

General McNair's comments expressed the conceptual outline

that ultimately led to tank destroyers. Although he fought the dispersion of antitank guns, he was willing to accept some scattering of those weapons. He noted that, " . . . guns should be provided organically in the infantry division, in order that it never may feel helpless against tanks."⁶

General McNair opposed tank-versus-tank combat because such action wasted tanks. He pointed out that, "[the tank's] natural and proper victim is unprotected personnel and material." To General McNair, a tank-versus-tank battle would be " . . . one in which both sides are certain to sustain heavy losses in costly materiel--which could be employed more profitably and effectively against more vulnerable targets."⁷

The ideas of mass and mobility were essential to General McNair's ideas for antitank warfare. He held that, " . . . the great mass of antitank and mobile antiaircraft guns should be held in large masses. This mass should shift along the front directly opposite the mass of enemy mechanization."⁸ Orienting on the enemy's tank forces, General McNair believed that this mass could always be superior to the enemy force in any particular locale.

It is significant that General McNair did not advocate any specific organization or particular weapons. He believed that such details should be determined by field tests. By stating only general concepts, McNair avoided being maneuvered into defending a doctrine that had not been fully developed. McNair maintained flexibility in relation to future planners and avoided interfering with details of organizations or weapons, although he might disagree with specifics. Thus General McNair's concepts for antitank warfare

were well developed by the summer of 1940.

When he assumed the duties of Chief of Staff of the GHQ in 1940, General McNair was in an effective position to influence Army policies. His duties with the GHQ placed him in direct contact with General George C. Marshall, the Chief of Staff. Since General Marshall's duties left him little time for direct supervision of the GHQ, General McNair became the de facto commander.⁹ General Marshall's selection of General McNair for these important duties is an indication of General McNair's influence with the Army's Chief of Staff.

General McNair's influence was apparent in a message that General Marshall sent to the War Department G3 on 14 May 1941:

I am certain that one of our urgent needs is for development, organization and immediate action of the subject of defense against armored forces to include an offensive weapon and organization to combat these forces.

He went on to comment that such a force should use rapid movement to intercept enemy forces and fight them with active defensive tactics. While General Marshall normally would have delegated the creation of such a force to one of the combat arms, he felt that the complexity of combined arms within such units would put them beyond the scope of any single arm. Therefore, General Marshall directed the G3 to take action on the matter, and he flatly stated that he did not want to bring up the question of a new combat arm.¹⁰

In the same memorandum, General Marshall directed the G3 to:

. . . organize in your division a small planning and exploring organization, composed of visionary officers, with nothing else to do but think out improvements in methods of warfare, study developments abroad and tackle such unsolved problems as measures against armored force action

The G3 established the Planning Branch the following day. A relatively unknown Lieutenant Colonel, Andrew D. Bruce, was named to head the new organization. His most important duty became the creation of the new antitank units.¹¹

During the summer of 1941, two events occurred that encouraged American endeavors toward antitank defense. First, the Germans destroyed over 200 British tanks in a single battle in North Africa. This was the first case where a large mass of tanks had been decisively stopped. The first defeat of a large force of tanks was good news in the United States, even though the prospective foe had been the victor. In addition, the maneuvers of the Second Army in Tennessee had demonstrated that the location of large enemy tank units would be known constantly. This would permit friendly antitank units to be moved and massed to combat enemy tank units.¹²

Soon after the Second Army maneuvers, the War Department G3 hosted an important antitank conference. The weighty assembly at the Army War College included representatives of the War Department and GHQ; antitank officers from armies, corps, divisions, and service schools; and the Chiefs of Engineers, Artillery, and Infantry. The significance of the conference was twofold. Most important, it showed that the most influential figures in the Army's bureaucratic hierarchy had lined up to support the Chief of Staff's position concerning antitank doctrine. The participants were able to agree on the concept of a mobile, semi-independent tank-killing force.

The most serious note of disagreement at the conference was the statement from Major General Courtney Hodges, Chief of Infantry, that the infantry should not be left unprotected against tanks.¹³ Arrival at a consensus concerning the controversial topic of anti-tank warfare was a milestone.

Only slightly less important, the conference revealed that the outline of the tank destroyer force was already quite well defined. General Twaddle emphasized at the conference that the broad aspects of the problem of building a tank destroyer force could be divided into two phases: first, determining how to use equipment that was readily available and how to organize it properly; and second, developing weapons, organizations, and tactics to stay ahead of any foreign developments.¹⁴ The proposed antitank unit that was explained at the conference included a headquarters battery, a reconnaissance battery, and three antitank batteries.¹⁵ Perhaps the most significant change in organization was the use of the term "company" instead of "battery."

The aggressive nature of the new units was emphasized by General McNair, who made the closing remarks at the conference:

The counterattack long has been termed the soul of defense. Decisive action against a tank attack calls for a counterattack in the same general manner as against the older forms of attack. A counterattack of course may be delivered by other tanks, but the procedure is costly. There is no reason why antitank guns, supported by infantry, cannot attack tanks just as infantry, supported by artillery, has attacked infantry in the past. Certainly it is poor economy to use a \$35,000 medium tank to destroy another tank when the job can be done by a gun costing a fraction as much. Thus the friendly armored force is freed to attack a more proper target, the opposing force as a whole in much the same manner as seacoast defenses free the Navy for defensive action at sea.¹⁶

Following the July conference, the tank destroyer concept made rapid progress. General McNair ordered the Second and Third Armies to form provisional battalions for use in maneuvers, and the Third Army was ordered to form groups of three battalions, each under a single group headquarters, in an effort to further centralize antitank operations. The employment of these units during the major maneuvers during the fall of 1941 was generally successful, although there was a tendency to disperse the units too quickly and thus dissipate their strength.¹⁷

In view of the success of the provisional antitank units, the War Department G3, General Twaddle, developed long-range plans for such units. The G3's office recommended 4 antitank battalions per division for the 55 divisions it envisaged. Of those 220 battalions, 55 would be organic to the divisions; 55 were allocated to armies or corps; and the remaining 110 would be reserved for the GHW.¹⁸ The large number of antitank battalions (220) recommended is an indication of the seriousness with which the War Department viewed the armored threat.

General Twaddle also recommended that the three established arms--infantry, cavalry, and field artillery--who had an interest in antitank warfare should each be given the responsibility to form antitank battalions for their own units. The Armored Force, which had not wanted the responsibility for antitank units, was to establish an antitank center.¹⁹

Marshall's response to this recommendation was a victory for General McNair and his desire to centralize antitank units. General

Marshall directed that the established branches assume no responsibility for the new units. Further, he stated that the antitank center would be under the War Department's control. The War Department allotted no battalions to divisions. All of the 55 battalions ordered for immediate activation were to be under the control of the GHC.²⁰

The establishment of an antitank center was not intended to create a new arm. Instead, the center was to be similar to the machinegun centers established during World War I. It would offer a central place for training units with a new type of weapon and new tactics, since such expertise was lacking in the Army as a whole. The trained units would then be allotted to existing organizations.²¹

On 27 November 1941, the War Department ordered the activation of the Tank Destroyer Tactical and Firing Center.²² This day can most nearly be called the official birthday of tank destroyers. Colonel Bruce was named to command the new center which was located at Fort Meade, Maryland until a permanent site could be determined.²³

The directive of 27 November also marked the creation of a new name for antitank units. The term "tank destroyer" had been used on various occasions for months, but "antitank" had remained the official term. The title of "tank destroyer" was made official on 3 December by the War Department in a directive that ordered all antitank battalions to be redesignated "tank destroyer" battalions, since the old term smacked too much of passive, defensive tactics.²⁴

The new Tank Destroyer Center consisted of a Headquarters,

a Tactical and Firing Center, a School, and a Tank Destroyer Board. The Center was charged with developing doctrine, cooperating in the development of equipment and organizing and operating the Firing Center, School, and Board.²⁵ Like the rest of the Army, the Tank Destroyer Center entered a period of rapid expansion.

By the end of December, Colonel Bruce had managed to assemble a skeleton staff at Fort Meade. During January 1942, a permanent site was selected at Kileen, Texas, but the Center did not officially move there until 14 February. Even after the Center had moved, it had to stage its operations from Temple, Texas, since there were no facilities at the Kileen site, which had been christened Camp Hood. Some of the civilians who owned property on the site had to be forcibly removed. The first tank destroyer battalions, which arrived at Camp Hood in March and April of 1942, had to move into field sites on the reservation and use materials from old CCC camps for construction. The completion of a limited number of buildings finally permitted the Headquarters of the Tank Destroyer Center to move into Camp Hood on 20 August 1942. In spite of its problems, the Tank Destroyer Center was able to train and release 42 battalions by 13 April 1943.²⁶

One of the most significant accomplishments of the Tank Destroyer Center during this formative period was the completion of Field Manual 18-5, Organization and Tactics of Tank Destroyer Units which was published in June 1942.²⁷ This manual spelled out the basic doctrine for all tank destroyer units and is the clearest presentation of the antitank concepts for such units as conceived

prior to US involvement in combat. Even after the war, the men who had developed the concepts were steadfast in supporting them. As representatives of the Tank Destroyer Center commented after the war:

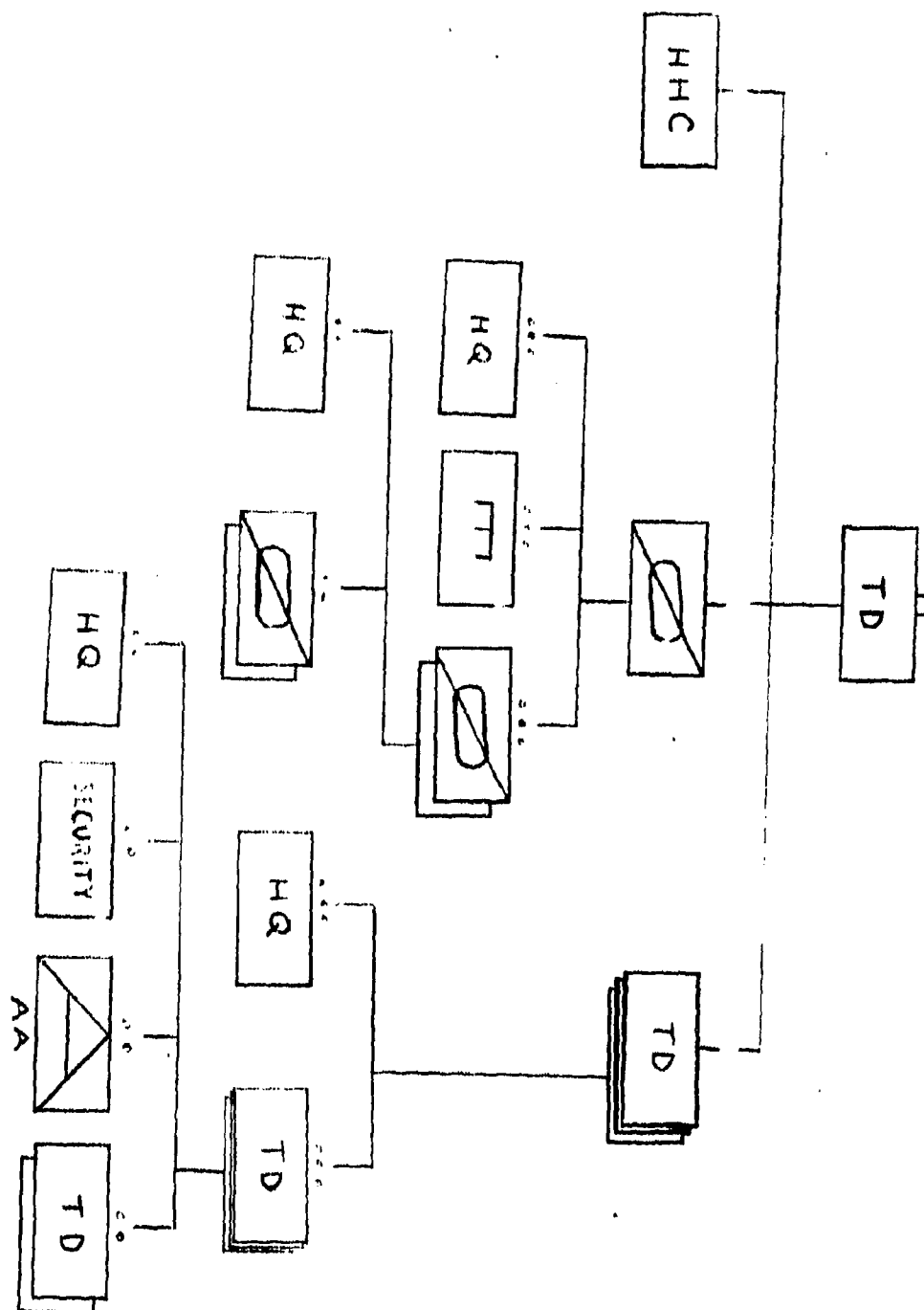
Although this manual has since been revised, tank destroyer officers most closely associated with the development of tank destroyer doctrine and tactics, some of whom have observed tank destroyer units in action overseas, believe that the basic doctrine set forth in this first edition of Field Manual 18-5 was, and is, correct.²⁸

The organization outlined by the FM 18-5 Manual was, in effect, a combined arms team organized as a battalion. The combination of arms extended down to the level of the platoon. Each platoon had four sections. The base of the platoon was formed by two gun sections, each with two guns. A security section protected the flanks of the platoon and, as an additional duty, performed reconnaissance for the platoon. The section was mounted in two armored cars. An antiaircraft section of two vehicles protected the gun sections from enemy aircraft, which reportedly accompanied every German tank attack. The platoon leader rode in his own armored car. The platoon also had an ammunition vehicle (fig 1).²⁹

The tank destroyer company was composed of three tank destroyer platoons with a total of 12 guns. Two of the platoons were heavy, while one was light. The only difference between the light and heavy platoons was the fact that the gun sections of the light platoon had light antitank guns. The company also possessed elements for various services including motor maintenance.³⁰

The battalion's headquarters company supported the battalion staff and provided the normal battalion services, such as transpor-

Figure 1. Tank Destroyer Battalion



tation. Three similarly organized tank destroyer companies formed the basis of the battalion. However, the battalion also controlled one element whose size was unusual for a battalion, a reconnaissance company.³¹

Organized with three platoons, the reconnaissance company was intended to scout ahead of the battalion to find routes and firing positions and to protect the tank destroyer companies from surprise. Each reconnaissance platoon had two sections, each with an armored car and several light vehicles. In addition, the reconnaissance company had a pioneer platoon whose duties were to aid the movement of the battalion by construction work and removing obstacles. In defense, the pioneer platoon was charged with laying minefields.³²

Thus, the tank destroyer battalion was a combination of direct fire artillery (antitank guns), mobile infantry (security sections), and cavalry. The only element of combined arms that was missing was indirect firepower. However, FM 18-5 mentions the possibilities of 81-mm mortars being organically assigned or of the use of a battalion chemical platoon to fire smoke.³³

In addition to the organization of battalions, FM 18-5 also discussed the organization of group headquarters for tank destroyers. The group headquarters was strictly a tactical headquarters of about company size. Its main assets were communications and a group staff. Intended to control several battalions (usually three), the group headquarters was designed for temporary assignment to major maneuver units, such as a corps, to organize tank destroyer forces against a major tank threat.³⁴

Aggressiveness was the watchword of tank destroyer tactics. As FM 18-5 described their role, "Tank destroyer units are especially designed for offensive action against hostile armored forces."³⁵ However, "offensive" as used in tank destroyer tactics must be qualified. It did not mean, as it did in tank or infantry units, to close with the enemy. For tank destroyers, ". . . offensive action consists of vigorous reconnaissance to locate hostile tanks and movement to advantageous positions from which to attack the enemy by fire."³⁶ The important distinction between attacking and attacking by fire was apparently not understood by some commanders.

Another integral aspect of tank destroyer doctrine was the tank warning net. This net was not a responsibility of the tank destroyers. The major maneuver units such as corps or divisions were expected to establish such nets, and available tank destroyers would react to the information.³⁷

A typical scenario might best explain the doctrinal operation of a tank destroyer battalion. The battalion would receive word through the warning net of an enemy tank attack. Operating from a position in the rear, the battalion would dispatch the reconnaissance company to gain contact with the enemy force and inform the battalion of enemy dispositions and locations. Using the information gained by the reconnaissance company, the battalion commander would move the tank destroyer companies to advantageous positions where they could bring the enemy under fire. Doctrinally, the battalion would destroy the enemy armor or delay the enemy until enough tank destroyers could be assembled to annihilate the tank

force. Preferably, a tank destroyer group or groups in sufficient strength to counter the enemy armor would have been assembled prior to the attack.

One important aspect of tank destroyer doctrine was later to prove unacceptable to most division commanders. The tank destroyers were not to be used to defend the frontlines. As FM 18-5 stated, "Organic antitank weapons of front line units are used for this first line of defense; tank destroyer units form the mobile reserve."³⁸ The foregoing statement assumes a penetration of friendly frontlines, particularly since the bulk of the Army's antitank assets had been concentrated in tank destroyer units. The logic of this was based on the lessons of the European War as perceived in the United States. A massed tank attack could always penetrate a frontline, since it was impossible to make the entire front rich enough in antitank weapons to stop such an attack. Therefore, tank destroyers should not be frittered away to defend against the initial attack but should remain in reserve so they could concentrate to stop the breakthrough.

As a corollary to concentration, tank destroyers oriented on the enemy force rather than on terrain. This was a rather unique aspect of tank destroyer doctrine. Most ground combat units of battalion size habitually spelled out their objectives in terms of terrain. Tank destroyers, however, used terrain as a means and not as a goal.

One idea not specifically mentioned in General McNair's writing or in FM 18-5 was the concept of pooling assets. If a specific type of unit was not needed continuously by a division,

it should not be made an organic part of the division. Such units, if assigned, were wasted when not in use. General McNair believed, therefore, that special units should be pooled and attached to divisions as needed. This enabled the Army to reduce the total number of such units and employ those available more economically. McNair used the concept of force pooling throughout the organization of the Army's ground combat forces, applying it to antiaircraft and separate tank battalions as well as to tank destroyers.

The doctrine of the pooled tank destroyer forces made it vital for tank destroyers to have mobility superior to tanks. Tank destroyers had to be able to move fast enough to intercept the enemy force and then avoid close combat with the tanks or their supporting infantry. In addition, the tank destroyers needed to arrive at the battlefield first in order to select firing positions. FM 18-5 stressed the necessity for tank destroyers to fire while stationary, preferably from covered positions, thus enabling them to fire much more accurately than the moving tank.

The need for mobility had convinced the men of the Tank Destroyer Center to adopt self-propelled rather than towed guns. As FM 18-5 stated, "The primary weapons of tank destroyer units are self-propelled guns" ³⁹

There had been a long controversy over the relative benefits of self-propelled versus towed guns. Even as late as the Antitank Conference of July 1941, the matter had not been settled. Colonel Bruce commented at the conference that:

As to the limbered weapon or the self-propelled weapon controversy suffice it to say that we shall have limbered weapons for some time to come but we shall develop and try out the self-

propelled mount. 40

However, by the spring of 1942, Brigadier General Bruce (recently promoted) and his men had definitely decided on self-propelled guns.

Significantly, the main supporter of the tank destroyer concept, General McNair, was a firm believer in the towed gun. Early in 1941, General Marshall directed that a study be made of the possibility of developing a self-propelled antitank gun, and he commented that:

It occurs to me that possibly the best way to combat mechanized forces would be to create antimechanized units on self-propelled mounts, with emphasis of visibility (on the part of the gunner), mobility, heavy armament, and very little armor."⁴¹

General McNair was quick to disagree with General Marshall's point of view.

General McNair had had considerable experience with a self-propelled gun in about 1930 and " . . . felt no hesitation in condemning it."⁴² McNair believed that the advantages of self-propelled mounts were few and were far outweighed by their disadvantages. He tabulated the following comparison:

A. Advantages.

1. Speed of entering action and withdrawing from it.
The latter is a doubtful advantage, since such guns should stay, not move.
2. Protection of cannoneers by armor.

B. Disadvantages.

1. Vulnerable target due to size.
2. Concealment in action difficult.
3. Unstable firing platform.
4. Probably slower due to weight.
5. Disability of either gun or motor renders both useless.
6. Greater weight (bridges).
7. Probably greater cost and slower production.⁴³

Despite this, General McNair did not interfere with the decision to

adopt self-propelled weapons for tank destroyers. However, the controversy was by no means settled in the spring of 1942.

Indeed, the problem of equipment was probably the most uncertain issue of the tank destroyer doctrine as stated in FM 18-5. The manual admitted that:

It is prepared for the guidance of units that will be equipped with materiel now being developed; units equipped with substitute materiel must interpret and modify the provisions of this manual to fit their particular needs.⁴⁴

Substitute equipment was to be the rule for tank destroyer units for nearly 2 more years.

Despite lingering problems of equipment, the US Army, during the early years of the Second World War, had moved decisively to counter the threat of enemy tanks. While General McNair's early concepts of a pool of mobile antitank guns had been hardened into tactical doctrine and organized units, military technology, as it existed during those early years, could not provide immediately the weapons needed to implement the desired tactics for tank destroyers. The search for the right weapons was to be a matter of diligent effort and heated controversy.

ENDNOTES

¹There is probably no finer source for this comment than in the words of Maj. Gen. Andrew D. Bruce, first commander of the Tank Destroyer Center. In a letter to Lt. Col. George Dean, dtd. 1 March 1944 (Bruce), Bruce said, " . . . General McNair has been the big man behind antitank or tank destroyer work as he has been in many other things."

²The Command and General Staff School, Antimechanized Defense (Tentative) (Fort Leavenworth, Kansas: The Command and General Staff School Press, 1939).

³Ibid., p. 13.

⁴Memo from Maj. Gen. George A. Lynch to Asst. Chief of Staff, G-3, dtd. 3 July 1940, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

⁵Letter from McNair to The Adjutant General, dtd. 29 July 1940, 2d Ind. to Memo from Lynch to G-3, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

⁶Ibid.

⁷Ibid.

⁸Letter from McNair to Lt. Col. Earl W. Benson, dtd. 20 June 1940, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

⁹Kent Roberts Greenfield and Robert R. Palmer, The Organization of Ground Combat Troops (Washington, D.C.: Hist. Div. U.S. Army, 1947), pp. 1-33.

¹⁰Memo from Chief of Staff to Asst. Chief of Staff, G-3, dtd. 14 May 1941, quoted in its entirety in "History of the Tank Destroyer Center," RG 337, National Archives, pp. 6-7. This document is in four parts which cover four periods: 1 December 1941 to 15 November 1943, 16 November 1943 to 28 February 1944, 1 March 1944 to 31 October 1944, and 1 November 1944 to 8 May 1945. Hereafter it will be cited, respectively as TDC Hist. I, TDC Hist. II, TDC Hist. III, and TDC Hist. IV.

¹¹Ibid.

¹²Ibid., p. 8. This source does not identify the battle which must have been General Sir Archibald P. Wavell's attack of 15 June 1941.

¹³AT Conf., pp. 45-46.

¹⁴Ibid., n. 7.

¹⁵Ibid., pp. 76-77.

¹⁶Ibid., p. 82.

¹⁷TDC Hist. I, Chap. I, p. 14.

¹⁸Ibid., p. 15.

¹⁹Ibid.

²⁰Ibid.

²¹Letter from Bruce to Brig. Gen. Earnest J. Dawley, dtd. 13 June 1944, Bruce.

²²Lt. Col. Emory A. Dunham, Tank Destroyer History, Study No. 29 (Historical Section--Army Ground Forces, 1946), p. 6, hereafter cited as Study No. 29. After March 1942 the Center received the title Command. However, Dunham does not clarify the distinction between Command and Center; both terms were used. To avoid confusion for the reader, this study will use the term Center throughout.

²³Ibid.

²⁴Ibid., pp. 6-7.

²⁵Ibid.

²⁶Ibid., pp. 10-11.

²⁷Ibid., p. 10.

²⁸Ibid.

²⁹U.S. War Department, Organization and Tactics of Tank Destroyer Units, FM 18-5, dtd. June 16, 1942, pp. 32-48, hereafter cited as FM 18-5, 42.

³⁰Ibid., pp. 48-55.

³¹Ibid., pp. 56-67.

³²Ibid., pp. 65-67.

³³Ibid., p. 55.

³⁴Ibid., pp. 113-122.

³⁵Ibid., p. 7.

³⁶Ibid., p. 19.

³⁷Ibid., pp. 127-128.

³⁸Ibid., p. 7.

³⁹Ibid., p. 8.

⁴⁰AT Conf., p. 28.

⁴¹Memo from Col. Orlando War, Secretary, General Staff to Asst. Chief of Staff, G-3, dtd. 8 January 1941, RG 337, (HQ, AOF), file no. 470.8 to 680.3, National Archives.

⁴²Letter from McNair to Asst. Chief of Staff, G-3, dtd. 16 January 1941, 1st Ind. to memo from Ward to G-3, RG 337 (HQ, AOF), file no. 470.8 to 680.3, National Archives.

⁴³Ibid.

⁴⁴FM 18-5.42, p. iv.

CHAPTER 2

DEVELOPING EQUIPMENT, 1940--1942

As General Twaddle had mentioned at the Antitank Conference, the problem of equipping tank destroyer units involved two phases: first, making use of what was immediately available; and, second, developing weapons to go beyond any foreign developments. Colonel Bruce reinforced General Twaddle's ideas at the conference and emphasized that the two problems should be handled simultaneously rather than successively.

While Colonel Bruce knew that development would take years, he described general characteristics for the "ideal tank destroyer." He commented at the conference:

What we are after is a fast-moving vehicle armed with a weapon with a powerful punch which can be easily and quickly fired and in the last analysis we would like to get armored protection against small arms fire so that this weapon cannot be put out by a machine gun.¹

Colonel Bruce noted also that the "super-duper" tank destroyer would have its gun "pointing to the front or in a turret." He expanded his ideas with naval terms by saying:

The tank destroyer that we have in mind is in reality similar to the battle cruiser. Its tactics in operating against the tank (the battleship) have to be different from the tactics we would employ in operating the tank (the battleship) against the tank (the battleship). Speed, visibility, and hitting power of the tank destroyer should compensate to some degree for its lack of armor. The tank destroyer must be cheaper in time and material for production than the tank.²

Colonel Bruce (and later the officers of the Tank Destroyer Center) realized that the ideal tank destroyer would take years to

develop, but the characteristics mentioned by Colonel Bruce in the summer of 1941 were very important in this development. Doctrine was written for the ideal tank destroyer, and the characteristics he pointed out guided development efforts of the Tank Destroyer Center. Just as important, proposed or expedient weapons were measured against the characteristics that Colonel Bruce stated in July 1941.

During the antitank conference, Colonel Bruce mentioned those weapons that were immediately available in reasonable quantities. Most important were the 37-mm gun, the standard antitank gun, and the 75-mm gun which was to be replaced as the standard field artillery piece. The major problem with both weapons was finding means to make them self-propelled. Colonel Bruce also mentioned efforts being made to mount the 3-inch antiaircraft gun on limbered and self-propelled carriages but noted that none of those weapons would be available before spring of 1942.³ The early days of the Tank Destroyer Board found that organization trying to bring different versions of the three weapons to completion.

When the Board was established on 1 December 1941, there were eight types of 37-mm gun carriages, two types of 75-mm gun carriages, and three types of 3-inch gun carriages under test or nearing completion.⁴ Winnowing out the best of the various carriages was the Board's first major task.

The most complete carriage was the one for the 75-mm gun, the T-12. An example of this vehicle had been completed in time for inspection by the conferees at the Antitank Conference.⁵ It

was merely a 75-mm gun mounted on a half-track and finally standardized as the M-3.

Inspiration for the M-3 had come from a French designer who mentioned to Colonel Bruce that the French Army had successfully mounted 75-mm guns on the back of trucks. The idea interested Bruce and other members of the Planning Branch. Viewing the Army's new half-track personnel carrier at Aberdeen a few days later had given further encouragement to the Planning Branch. Soon after that, General Twaddle agreed with ordnance officers to try out the mount.

Despite its hasty beginning, the M-3 was quite successful. By 1 December, 86 had been completed, and 50 of these were immediately sent to the Philippines. The remainder equipped the first provisional tank destroyer unit. However, Colonel Bruce had made it very clear at the Antitank Conference that the weapon was an expedient.⁶ It was desirable, since it made use of the 75-mm guns available and offered suitable equipment for training. In fact, the M-3 remained standard equipment for tank destroyer battalions into 1943.

The M-3 only approximated the desired characteristics for a tank destroyer. Its thin sides and gunshield offered protection against only small arms fire and not even then if armor piercing ammunition was used. Exceeding the mobility of tanks only on roads, the M-3 was disappointing when operated across the terrain. Probably the best feature of the weapon was the gun. The venerable 75-mm gun proved to be adequate against virtually all the enemy

tanks that it faced in 1942. In addition, there was a large variety of ammunition available in plentiful supply. Probably the main weakness of the gun was its relatively low velocity (2,000 fps.), which caused some difficulty in obtaining hits in range, particularly against moving targets. Despite its problems, the M-3 was to prove to be the best gun motor carriage available during 1942.

Efforts to provide a carriage for the 37-mm gun were less successful. Most of the carriages under study were merely small trucks that could carry the gun. Light trucks (1/4 ton) proved unable to withstand the firing of the gun, while heavier, armored vehicles required long development periods. The compromise was the Fargo, a shielded 37-mm gun mounted on a pedestal in the back of a Dodge, 3/4-ton truck.

The Tank Destroyer Center intended to use the Fargo, classified as M-6, only in training.⁸ However, the first tank destroyer units that arrived in North Africa still had the vehicles. The Fargo's obvious problems were accentuated in combat.

By far the most serious defect in the M-6 was its lack of armor. The vehicle was vulnerable to all types of fire, and the problem was amplified by the short range of the 37-mm gun that made a close approach to the enemy imperative. Moreover, a 4 x 4 truck simply could not match the mobility of tracked vehicles when moving cross-country. Still, the M-6 was cheap and above all available.

Neither the 37-mm gun or the 75-mm gun were to remain as mainstays of tank destroyer firepower. The most important gun soon became the 3-inch, an obsolete antiaircraft weapon.

Originally designed for seacoast defense, the 3-inch gun had

been adapted for antiaircraft use and was employed in that role during the interwar years. By 1940, the 3-inch gun was no longer in production since its replacement, the 90-mm, was already in sight, but production could be quickly resumed since all the necessary tools and dies were in storage. Like the 75-mm gun, 3-inch ammunition was already perfected. The high velocity (2,600 fps.) necessary for fire against aircraft made the 3-inch gun a natural candidate for use against tanks.⁹

Significantly, Colonel Bruce moved toward high-velocity guns more for their flatter trajectory in relation to the 75-mm rather than for their greater penetrative power.¹⁰ As General McNair had pointed out in 1941, "The prime essentials of an antitank gun are unusually clear-out: first, to hit; second, to penetrate upon hitting."¹⁰ During 1942, the 75-mm seemed to have adequate penetrative qualities. For example, Brigadier General Gladeon M. Barnes, head of the Ordnance Department's research and development, reported after a visit to North Africa that, "The 75-mm gun in the M-4 tank has destroyed the best German tanks at ranges as great as 2,500 yards."¹²

While searching for other means to achieve flatter trajectories, the Tank Destroyer Center also considered the 57-mm antitank gun, which was being produced in the United States during 1942 for British requirements. The 57-mm offered virtually the same penetrative capabilities as the 75-mm but with greater (2,750 fps.) velocity. However, there were reports that the gun's solid shot shattered against the face-hardened armor on German tanks.¹³ As a further disadvantage, the English had not designed high-explosive

ammunition for the 57-mm.

Lacking an alternative, the 3-inch gun became the focus for increasing the firepower of tank destroyers. The increased penetrative capabilities of the 3-inch gun were a welcome and fortuitous adjunct to its flatter trajectory.

With admirable foresight, General Barnes had moved to adapt the 3-inch gun for antitank use in the fall of 1940. On 9 September, General Barnes directed the Artillery Division to draw a layout for the gun to be mounted on the carriage of a 105-mm howitzer. General Barnes noted that, " . . . this combination might make a very satisfactory antitank gun of great power."¹⁴

By 26 December, the Ordnance Technical Committee, the official body in the Army which coordinated ordnance developments, had approved the development of the 3-inch antitank gun. Sharp disagreement came in the form of a nonconcurrence from Fort Benning since:

In view . . . of the lack of information as to the need for a weapon with the great penetrating ability of the subject gun, the Chief of Infantry cannot agree that there is a need for antitank materiel of such great weight and consequential poor mobility.¹⁵

Despite opposition from the Infantry, development of the 3-inch gun continued. On 22 October 1941, technicians at Aberdeen fired the first prototype. Less than a month later, 12 November 1941, the Ordnance Technical Committee recommended that the gun be standardized.¹⁶ However, the 3-inch gun on a towed carriage would have to wait for standardization.

In February 1942 the Ordnance Department shipped the gun to Fort Bragg for tests by the Field Artillery Board.¹⁷ That agency was far less enthusiastic than the Ordnance Technical Committee.

Tests at Fort Bragg revealed numerous deficiencies. The most serious problems were the difficulty in traversing the weapon on side slopes and the position of handwheels which made the gunners unable to traverse and elevate the tube while keeping their eyes to the sight.¹⁸ These technical deficiencies were not to be the main problem with the 3-inch gun.

Army Ground Forces (AGF) requested that production of the 3-inch gun be cancelled on 13 May 1942, and this request was approved by Services of Supply (SOS), later renamed Army Service Forces (ASF), on 21 May.¹⁹ Major General Levin H. Campbell, Chief of Ordnance, protested strongly.²⁰ He was answered by a memorandum from ASF on 26 July that enumerated the technical deficiencies of the weapon. The clinching argument was that, " . . . the Tank Destroyer Center, sole users of the 3" Antitank gun, consider it essential that this gun be self-propelled." Brigadier General Lucius D. Clay, Assistant Chief of Staff for Materiel of SOS, concluded that: " . . . this Headquarters feels that the decision to cancel the project for a towed 3" Antitank Gun was well considered."²¹

The towed 3-inch gun was soon resurrected. Ironically, the failure of a self-propelled version of the 3-inch gun, the Cletrac, breathed new life into the towed weapon.

The Cletrac, the name being derived from its manufacturer, the Cleveland Tractor Company, was a parallel development of the towed 3-inch gun. In appearance and concept, the Cletrac was similar to the 90-mm gun SPAT that equipped American airborne units in the 1950's and 60's. In 1940, the Cleveland Tractor Company sub-

mitted a design for a self-propelled gun based on its high-speed tractor that was used to tow military aircraft. The Ordnance Technical Committee approved the idea on 19 December 1940, specifying that the vehicle would mount the 3-inch gun.²²

The manufacturer could not deliver a prototype of the carriage, designated T1, until November 1941.²³ Despite numerous problems with the prototype, the Field Artillery Board recommended standardization of the Cletrac. The Ordnance Technical Committee concurred with the Artillery Board's recommendation on 24 November 1941. Significantly, the newly created Tank Destroyer Center was not a signatory of this action. The Adjutant General subsequently approved standardization of the Cletrac as the M-5 and directed procurement of 1,580 vehicles on 7 January 1942.²⁴

Numerous modifications failed to correct the original deficiencies of the Cletrac. In addition, its weight grew from the 8 tons originally envisaged to nearly 12 tons. The vehicle's speed fell proportionately. By May 1942, a modified vehicle at Fort Bragg exhibited various faults, including broken tracks and a propensity to catch fire.²⁵

Despite the Cletrac's numerous faults, the Ordnance Department went ahead with measures to put the vehicle into production. Increasingly, the M-5 became a vested interest of the Ordnance Department. The completion of a factory to build Cletracs indicated the commitment of ordnance officers to the future of the carriage.²⁶ However, none of this effort improved the Cletrac in the eyes of the officers of the Tank Destroyer Center.

Even if its mechanical deficiencies disappeared, the Cletrac still fell short of what General Bruce and his men wanted. Lacking armor except for a sunshield, the M-5's vulnerability to all types of fire was its principal fault. This condition was accentuated by carrying ammunition on the fenders and the fact that the gunner and loader rode in front of the shield. In addition, the speed of the Cletrac had fallen to 36 mph, no faster than light tanks of the day. General Bruce derisively referred to the M-5 as the "Creak track."²⁷

Finally, in July 1942, a vehicle incorporating all the repairs deemed necessary was available at Aberdeen. A crew from the Tank Destroyer Board arrived to test the vehicle. After being trained to operate the vehicle, the crew from Camp Hood gave the Cletrac a cross-country test. The results were disastrous. An Ordnance historian commented that "The sides were dished in, the gun supports buckled, the suspensions out of line, the travel lock folded, and the gun mount loosened."²⁸ General McNair admitted to General Bruce that the M-5 looked "pretty hopeless."²⁹

On 23 August 1942, AGF recommended to SOS that production of the M-5 be discontinued because it, " . . . is not a vehicle of sufficient capacity to handle the 3-inch antitank gun . . . [and] . . . it is unsatisfactory for Tank Destroyer use."³⁰ However, the demise of the Cletrac created another problem for McNair's efforts to improve antitank defense.

On 1 July 1942, AGF had decided to replace all 37-mm or 57-mm guns with self-propelled, 3-inch guns.³¹ The failure of the Cletrac left AGF without the desired substitute. The only available

carriage for the 3-inch gun was the M-10 motor gun carriage, which weighed some 30 tons. Therefore, in the same letter that recommended abandonment of the Cletrac, AGF requested that:

. . . in order to provide an additional antitank weapon of lighter weight than the M-10, it is desired that some of the 3-inch guns previously available for assignment to the M-5 be mounted upon the 105-mm Howitzer carriage (towed).³²

AGF asked for 500 towed 3-inch guns. Thus, the failure of the Cletrac rekindled interest in the towed 3-inch gun even though the Tank Destroyer Center did not want the towed weapon. The other carriage mentioned in the letter, the M-10, was also a bone of contention between General Bruce and the Ordnance Department.

The origin of the M-10 was a project initiated in October 1941 to mount the 3-inch gun in an M-3 tank chassis. The first attempt, the T-24, was simply a 3-inch gun mounted in an M-3 tank hull with very limited traverse. On 20 March 1942, the Ordnance Technical Committee agreed to develop a turreted carriage based on the M-4 tank. The proposed vehicle, the T-35, would be essentially an M-4 tank with lighter armor and a 3-inch gun mounted in a turret. Fisher Tank Division of General Motors managed to complete two prototypes in April and make the vehicles available for demonstrations at Aberdeen. On 2 May 1942 at Aberdeen, various interested parties met to consider production of the T-35.³³ Major General Richard C. Moore, Chief of AGF's Requirements Section; General Bruce; and General Barnes were at the meeting. Both Generals Moore and Barnes recommended that the T-35 be placed in production, while General Bruce disagreed vehemently.³⁴ Subsequently, General Moore overruled General Bruce and convinced General McNair to request

production of the T-35, which was soon standardized as the M-10.³⁵

General Bruce's objections to the M-10 were very simple. It " . . . weighs too much and is too slow," he commented.³⁶ The M-10 was barely faster than the M-4 and was slower than light tanks. Weight also restricted the mobility of the M-10 since it limited the types of bridges that the vehicle could cross. At the conference in May, General Bruce commented that, "At present I am unable to shift a medium tank from several parts of Texas a distance of 20 miles without making a detour of 150 miles to find a bridge that will carry it."³⁷

In addition to its weight and speed, the M-10 had other disadvantages. Probably the most important technical fault of the M-10 was the lack of power traverse. The overall imperfection of the design was exemplified by the necessity to hang counterweights on the rear of the turret to achieve balance. Despite its many faults, the M-10 would become, numerically, the most important tank destroyer in the Army's inventory. Fears revealed by Bruce during the conference at Aberdeen were realized.

The conference at Aberdeen on 2 May 1942 exposed an increasingly acrimonious relationship between General Bruce and the Ordnance Department. General Bruce fought standardization of the M-10 mainly because it was an expedient and partially because it was untested. He feared that accepting the M-10 might delay, or stop, his efforts to get an ideal tank destroyer. As General Bruce explained to General Richard C. Moore of the AGF's Requirements Section:

This standardization thing gets my goat. When that is done they might suddenly order 3000 guns on me. They might order those and stop seeking a better weapon.³⁸

General Bruce's misgivings were at least partially prophetic, the Ordnance Department ultimately built over 6,000 M-10's.

As revealed at the conference, the main objective of the ordnance officers was to produce enough 3-inch gun carriages to satisfy the requirements handed down from the War Department, with little regard for the quality of those carriages. When General Bruce complained, "We have enough expedient weapons," Colonel John K. Christmas of the Tank-Automotive Command retorted, "We do not have enough expedient weapons to finish up the S.O.S. objective that we were given."³⁹ Apparently agreeing with the Ordnance Department, Moore cleared the way for production of the M-10 despite General Bruce's objections.

The controversy between General Bruce and the Ordnance Department continued until General Bruce finally left the Tank Destroyer Center. During the remainder of 1942, the dispute was especially bitter. General Bruce later wrote of a "terrific battle with Ordnance."⁴⁰

The Ordnance Department argued that General Bruce did not make his requirements clear and asked for so many changes that development was delayed. Ordnance officers were not without support for their opinions. On 10 December, during a telephone conversation with General Bruce, Major General Jacob L. Devers of the Armored Force (who outranked General Bruce) chastised him for not telling the Ordnance Department what the Tank Destroyer Center wanted.

General Bruce argued that his desires had remained the same since 1941, but General Devers countered that characteristics were not enough, and General Bruce needed to follow up on development efforts.⁴¹ Further support for the Ordnance Department's point of view came from General Moore, who commented to General McNair in reference to one development project, "I do not see how Bruce can ever expect to get any kind of mount for his 3" gun if he keeps asking for changes in design."⁴²

General Bruce remained disgruntled with the Ordnance Department. He was later to remark bitterly, "The biggest obstacle to the creation of Tank Destroyers was found within the Ordnance Department."⁴³

Helping to clear the air, the Palmer Board eliminated several experimental vehicles that might have become matters of controversy. The Palmer Board was the popular name for the Special Armored Vehicle Board which was in session from October to December 1942. Headed by Brigadier General William B. Palmer, the board considered some 15 armored vehicles in order to recommend those vehicles for service use, development, or termination.⁴⁴ Several of the vehicles were of interest to the Tank Destroyer Center.

The Board pared some nine armored cars down to one, the T-22 which had been standardized as the M-8.⁴⁵ The Tank Destroyer Center had been interested in this vehicle since the Center viewed it as a replacement for the M-6, Fargo, as a light tank destroyer.⁴⁶ However, the M-8 was to be far more important as the standard armored car for American Cavalry units than for the tank destroyers.

Most important, the Board narrowed a field of three gun motor carriages down to one, the T-49. The two eliminated vehicles were a wheeled 3-inch gun carriage called the "Cook Interceptor" and a 3-inch gun mounted on an M-3 light tank chassis.⁴⁷ Both had great potential to arouse General Bruce's ire as further expedients. On the other hand, the T-49 promised to become the ideal tank destroyer.

The T-49 had originated in February 1942 when Bruce's review of some 200 vehicles under test by the Ordnance Department did not reveal a single vehicle satisfactory for tank destroyer use. This made it necessary to develop the ideal tank destroyer from scratch.

The driving force behind the decision to start afresh was the need for mobility. Volute spring and bogie suspension common to most of the Army's tracked vehicles would not permit enough speed, since vibration became destructive at high speeds.⁴⁸

General Bruce conferred with a representative of General Motors, and the two agreed that a Christie suspension was the answer. General Motors designed a track-laying vehicle with a Christie-type suspension. It was not a true Christie suspension, since the independent road wheels used coil springs rather than a roadwheel arm. The vehicle was to be designated the T-42 and was planned to carry a 37-mm gun, but the gun was changed to a 57-mm and the designation changed to T-49 on 3 April 1942.⁴⁹

Since the T-49 appeared to offer all of the characteristics desired for tank destroyers, General Bruce continued close coordination with Buick Motors. By 2 July 1942, he recommended that the armament be changed to a 75-mm gun. This vehicle was designated

the T-67.⁵⁰

On 3 September 1942, an example of the vehicle was available at Aberdeen for tests. During the test, General Barnes called General Bruce's attention to the new 76-mm gun.⁵¹

This gun was a minor coup for ordnance engineers. They had designed a new gun to fire 3-inch projectiles with the same external ballistics as the 3-inch gun. The new gun was lighter, smaller, and used shorter, space-saving ammunition. Even more beneficial to US tanks and tank destroyers, the 76-mm gun used the same breech block and recoil system as the 75-mm, thus making substitution relatively simple.⁵² General Bruce quickly perceived the advantages of the new gun.

Shortly after the Palmer Board, General Bruce met with representatives of industry and the Ordnance Department in Detroit, and they agreed on characteristics of a T-67 armed with the 76-mm gun. Included in the decision was a move from the Christie-type suspension to torsion bars. The Ordnance Technical Committee approved the new development project, the T-70, on 4 January 1943. Development of the ideal tank destroyer was underway after long months of effort and dispute during 1942.⁵³

During its first 18 months of existence, the Tank Destroyer Center had made great progress towards equipping its unique, new units. The two weapons that were immediately available, the 37-mm and 75-mm guns, had been adapted to self-propelled mounts. Although expedients, the M-3 and M-6 were useful for training, and the M-3 would prove surprisingly effective in combat. Other development projects were slower and more controversial.

The efforts to complete an antitank version of the 3-inch gun exposed the technical problems inherent in development. Despite an early start, mid-1942 still found the Ordnance Department struggling with the task of mounting the 3-inch gun on two wheels. The ultimate decision to build the towed 3-inch gun also surfaced other problems for the Tank Destroyer Center.

Despite General Bruce's objections concerning towed guns, AGF overruled him and ordered production of the weapon. This indicated that the Tank Destroyer Center would not unilaterally make decisions concerning the development of its equipment. AGF's decision to produce the M-10 over General Bruce's objections was further evidence of this fact.

The dispute over the other self-propelled 3-inch gun, the Cletrac, reveals much about the relationship between the developer, the Ordnance Department, and the user, the Tank Destroyer Center. Theoretically, the Ordnance Department would be expected to respond to the requirements of the Tank Destroyer Center. However, the Ordnance Department pressed ahead with the Cletrac despite General Bruce's vehement objections. For its own reasons, the Ordnance Department supported a project despite the user's views that the weapon was unsuitable for combat. Clearly, the Ordnance Department had independent views about the suitability of equipment and did not hesitate to support those views. Its refusal to passively accept requirements made the Ordnance Department another independent voice in the development process. General Barnes would not settle for merely expressing the technician's viewpoint. Furthermore,

General Bruce had to make direct contact with a manufacturer to instigate the development of the weapon that he desired, the T-70. General Bruce's action points out the lack of cooperation between the user and developer.

Despite the acrimony concerning development during 1942, the US Army had made great progress toward equipping the tank destroyer units. The 3-inch gun of the M-20 would provide greater firepower in a short time. The development of the T-70 was well advanced, and this weapon promised to be ideal for employing tank destroyer doctrine. Despite this progress, the first tank destroyer units in combat would have to fight with expedients, the M-3 and M-6.

ENDNOTES

¹AT Conf., pp. 29 and 32.

²Ibid.

³Ibid., p. 28.

⁴TDC Hist. I, Chap. VI, pp. 3-4.

⁵Ibid., p. 3, and AT Conf., pp. 28-29.

⁶Study No. 29, pp. 2-3, and AT Conf., pp. 28-29.

⁷TDC Hist. I, Chap. VI, pp. 3-4.

⁸Study No. 29, p. 9.

⁹TDC Hist. I, Chap. IV, pp. 8-9.

¹⁰Letter from Bruce to Brig. Gen. W. B. Palmer, dtd. 26 January 1943, Bruce.

¹¹Letter from GHQ (/s/ McNair) to the Adjutant General, dtd. 6 January 1941, RG 337 (HQ, AGF), file no. 470.8 to 680.3, National Archives.

¹²"Ordnance Annex," dtd. 18 January 1943 to "Report of the mission headed by Lieutenant General Jacob L. Devers to examine the problems of Armored Force units in the European Theater of Operations," RG 337 (HQ, AGF), file no. 320.2/26 (Armd C), National Archives, hereafter cited as Devers Rpt.

¹³TDC Hist. I, Chap. IV, p. 10, and memo from McNair to Chief of Staff, US Army (Attn: C-3), dtd. 5 January 1943, RG 337, file no. 472, National Archives. Hereafter, the AGF records containing sources from file numbers 470.8 to 473 for the years 1942 to 1945, inclusive, will be cited as AGF followed by the file number of the particular document, e.g. AGF (472). The memo gives the following useful comparison of the 57-mm, 75-mm, and 3-inch guns:

57-mm

weight--3,060 lbs. (with shield)
 penetration at 1000 yds.--2.9" (homogenous armor); 2.6"
 (face hardened armor)
 MV--2,750 fps.

75-mm

weight--3,450 lbs.
 penetration at 1,000 yds. (AP/APC)--2.9"/3.3" (homogenous
 armor); 2.6"/3.3" (face hardened armor)
 MV--2,050 fps.

3-inch

weight--5,240 lbs.
 penetration at 1,000 yds. (AP/APC)--4.0"/4.6" (homogenous
 armor); 3.75"/4.51" (face hardened armor)
 MV--2,600 fps.

¹⁴ Memo from Col. Barnes to Capt. Weyher, dtd. 9 September 1940, History of 3-Inch Gun Carriage M1, M1A1, and M6 (hereafter cited as 3-Inch Hist.), Ordnance Historical Files, RG 156, National Archives, hereafter cited as OHF.

¹⁵ Ordnance Committee Minutes, Item 16368, dtd. 27 December 1940, RG 156, National Archives, hereafter cited as OCM.

¹⁶ Chronology, 3-Inch Hist., entries for 22 October 1941 and 12 November 1941.

¹⁷ Chronology, 3-Inch Hist., entry for 28 February 1942.

¹⁸ Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 1st Ind. to Memo from Chief of Ordnance to CG, SOS, dtd. 17 July 1942, 3-Inch Hist.

¹⁹ Memo from Chief of Ordnance to CG, SOS, op. cit. mentions a letter from AGF and its indorsement by SOS.

²⁰ Ibid.

²¹ Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, op. cit.

²² Mrs. Anne B. Jones, 3-Inch Gun Motor Carriages, unpublished manuscript in OHF, "3-Inch Gun Motor Carriage M5 (T1)," p. 1 (All references to the Gletrac will be from the chapter above.), hereafter cited as Jones, Carriages.

²³ Ibid., p. 2.

²⁴OCM, Item 17642, dtd. 24 November 1941 with indorsements.

²⁵Jones, Carriages, pp. 2 and 7.

²⁶Ibid., p. 8. Jones only mentions the fact that a factory had been constructed.

²⁷Letter from Bruce to Col. Wendell Westover, Asst. Chief of Staff, G-2, Tank Destroyer Center, dtd. 24 November 1943, Bruce.

²⁸Jones, Carriages, pp. 7-8.

²⁹Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

³⁰Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-Inch Hist.

³¹Memo from HQ, AGF to CG, SOS, dtd. 1 July 1942, AGF (472).

³²Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, op. cit.

³³Jones, Carriages, "3-Inch Gun Motor Carriages M-10 M-10A1 (T35, T35E1)," pp. 1-2.

³⁴"Notes Taken at Conference at Aberdeen Proving Ground, Md. on May 2, 1942," Bruce, p. 1, hereafter cited as May 42 Conf.

³⁵"Statement of Colonel G. M. Dean," dtd. 18 October 1945, AGF (470.8).

³⁶Letter from Bruce to Brig. Gen. W. B. Palmer, 26 January 1942, op. cit.

³⁷May 42 Conf., p. 6.

³⁸Ibid., p. 13.

³⁹Ibid., p. 4.

⁴⁰Letter from Bruce to Westover, dtd. 24 November 1943, Bruce.

⁴¹"Rough Draft, Conversation between General Bruce and General Devers," undated, Bruce. From other documents the date of this conversation can be established as 10 December 1942.

⁴²Memo from RQT 1 (Moore) to McNair, 22 February 1943, AGF 473.1.

⁴³Letter from Bruce to Westover, undated, Bruce. From other documents the date of this letter can be established as generally

November 1943 to January 1944.

⁴⁴Letter from Brig. Gen. W. B. Palmer to the Chief of Staff, U.S. Army, Subject: "Final Report of Special Armored Vehicle Board," dtd. 5 December 1942, hereafter cited as Palmer Report, AGF (470.8).

⁴⁵Ibid.

⁴⁶TDC Hist. I, Chap. VI, p. 2.

⁴⁷Palmer Report.

⁴⁸TDC Hist. I, Chap. VI, pp. 15-16.

⁴⁹Study No. 29, p. 60.

⁵⁰Ibid.

⁵¹Ibid.

⁵²Ibid.

⁵³TDC Hist. I, Chap. VI, p. 17.

CHAPTER 3

COMBAT IN NORTH AFRICA

The tank destroyer units that participated in America's first land battle against the Germans, in North Africa, failed to prove the concepts expressed in FM 18-5. More important than the inadequacies of expedient equipment, senior commanders failed to use tank destroyer doctrine. Continual misemployment made the performance of tank destroyer units unimpressive. In contrast, the British and Germans seemed to have discovered an antidote to tanks--concealed, towed guns. The lack of success from US tank destroyers forced the Tank Destroyer Center to change doctrine, organization, and equipment. Tactical employment, not weapons, would be the main concern of tank destroyer units in North Africa.

The most serious malady of the tank destroyer battalions deployed to North Africa was their continuous misuse in relation to the tactical doctrine that governed their training and equipment. Tank destroyer concepts were strongly criticized by senior officers during the campaign in Tunisia, but there is little evidence that the concepts had been given a fair test. Shortcomings of TD equipment only added to the criticism. Missions given to tank destroyer units were often far outside the scope of their equipment or training. The doctrine for tank destroyer units, as reflected in FM 18-5, was never employed in North Africa.

Tank destroyer battalions were rarely employed as units.

As a rule, the tank destroyer companies were dispersed among larger units such as infantry regiments. The reconnaissance companies proved to be convenient assets for guarding the headquarters of corps commanders who seemed to be overly concerned with their own safety. The experiences of the first tank destroyer battalions to reach North Africa illustrate this point.

There were only two tank destroyer battalions, the 601st and 701st, in action in North Africa until mid-February 1943.¹ Of the two, the 601st was probably the first tank destroyer unit to be misused.

Originally deployed to England, the 601st quickly lost its reconnaissance company to guard the headquarters of II Corps, thus hampering the ability of the battalion to continue training. The 601st was subsequently deployed to North Africa without its reconnaissance company. On arriving in North Africa, the 601st was assigned to the British First Army which dispersed the battalion among subordinate units. By early 1943, an observer from AGF was able to locate one company of the 601st with an American task force and another company with Combat Command B (a brigade-size unit) of the 1st Armored Division. The observer was unable to locate the remainder of the battalion.²

A dispersed TD battalion could not fulfill the tank destroyer doctrine as discussed in chapter one. Even if the 601st had been allowed to retain control of its TD companies, it would have been difficult to deploy those companies properly without its organic reconnaissance company. Proper reconnaissance was an

imperative in FM 18-5. Of course, breaking down the battalion into its TD companies made it totally impossible to use tank destroyer concepts.

Suffering a similar fate, the 701st was part of the initial landing forces in Africa. It, too, was to lose its reconnaissance company to guard a corps headquarters, and the remainder of the battalion was dispersed.³ Later arrivals suffered the same fate. For example, the 805th was available at the Battle of Kasserine in February 1943 but " . . . was split up into companies which were destroyed in detail."⁴

The tank destroyers faced other problems as well. The missions assigned to the battalions or their detached companies rarely included the one mission that they were designed to accomplish, i.e. being a mobile reserve intended to fight a tank penetration. Tank destroyer units received missions better suited to tanks, cavalry, or artillery. One observer commented that a company of the 701st was used as, " . . . attacking tanks and subsequently as supporting artillery."⁵ Another witness affirmed that:

. . . they [the 601st and 701st] were generally used in roles for which they were not designed, such as infantry accompanying guns, assault artillery operating with tanks, and in cordon defense of areas instead of in depth.⁶

The Army's official history notes that the 601st was used as a screening force at Kasserine Pass where the battalion was nearly overrun.⁷ The narrative of the North African Campaign is replete with examples of ill-used tank destroyers.

One example, perhaps an extreme one, illustrates the misuse

of a tank destroyer unit. With an attached reconnaissance platoon, B Company, 701st Tank Destroyer Battalion, operated as an independent unit during November 1942. After an overland march from Oran, B Company was ordered to attack the town of Gafsa (See Map 1). Supported only by two antiquated, French armored cars, the company managed to secure the town from scattered German infantry by using tank destroyers like tanks. Warned of approaching armor, the company commander Captain Gilbert A. Ellman, elected to meet the enemy at El Quettar where the terrain was more suitable for maneuver. In a meeting engagement, B Company managed to destroy four tanks and drive off the enemy force.

Returning to Gafsa, the company was immediately directed to respond to an enemy attack at Sbeitla. Captain Ellman received an order to " . . . go up there and do something about it." Surprising the enemy at Sbeitla, Captain Ellman fixed the force by fire with one platoon and flanked with another. After losing 11 tanks, the Italians retreated from the town.⁸

B Company had received missions far outside the intent of FM 18-5. Aggressive leadership, good tactics, and poor enemy performance enabled the unit to accomplish its missions successfully. It should be noted that the reconnaissance platoon was instrumental to success in all of the actions. However, such offensive missions against a more determined enemy were far less successful. As a witness of later actions commented:

The tank destroyer is definitely a defensive weapon. Wherever destroyers have bulged out on their own and tried to fight German tanks they have been knocked out.

Their equipment and doctrine made tank destroyer units defensive organizations. As one action in North Africa demonstrated, when employed properly, tank destroyers were effective at their intended task—killing tanks.

During March 1943, the 1st Infantry Division was advancing into northern Tunisia near El Guettar. The Germans dispatched the 10th Panzer Division to counterattack the American advance.¹⁰ Major General Terry Allen, commander of the 1st Infantry, had ordered the 601st TD Battalion, finally assembled, to deploy into positions protecting the division artillery (See Map 2).¹¹

When the German attack with some 100 tanks began in the early, dark hours of 23 March, it was detected by reconnaissance elements of the 601st that had been placed well forward. Warned of the approaching armor, the 601st was able to adjust its positions which had been intended to oppose infantry. Two Tigers were among the 30 tanks knocked out by the 601st during the battle. Although the 601st lost 21 of 31 M-3's, the German attack was repulsed.¹²

El Guettar was almost a classic example of proper employment of tank destroyers. Massing the battalion on excellent terrain had enabled it to counter a German force that out-numbered the Americans three to one. The tactics of the battalion were excellent. Shifting positions had avoided both artillery and tank fire, and the use of covered positions prior to firing had kept losses from soaring higher.¹³

The only criticisms of the action in relation to tank destroyer doctrine were that the battalion was unduly exposed since there were no divisional units between the TD's and the enemy, and

that the unit was too far forward. Preferably, the tank destroyers would have been behind the division's artillery, where they could have maneuvered to counter the tanks, but being tied to the mission of protecting artillery restricted their ability to maneuver. Neither criticism outweighed the overall advantages of a massed tank destroyer battalion screened by its own reconnaissance. The saddest thing about the tactics of El Guettar was that they were not used at Kasserine.

Despite success at El Guettar, the tank destroyer concept did not prove itself in North Africa. The failure of tank destroyermen to prove their doctrine to senior commanders was largely due to the failure of those same commanders to use the units properly. Several factors were involved in the misemployment of tank destroyer battalions.

One observer believed that the dispersal of tank destroyer units was due " . . . to the necessity of holding a wide front with little means."¹⁴ While there is some logic in spreading assets along a wide front, it would have been just as logical to keep the tank destroyers in reserve locations to react to German penetrations on critical avenues. The desire of the commanders for a piece of the TD pie must have been strong. This tendency is common to armies and other bureaucracies.

In defense of the dispersal of tank destroyers it must be pointed out that the American forces in North Africa did not face German tank attacks on a daily basis. Quite reasonably, generals are loath to leave an important asset sitting in reserve when it

could be firing on the enemy. In this light, the failure of American commanders was the refusal or inability to concentrate tank destroyers when a German tank attack was imminent or actually underway.

Contributing to the misuse of tank destroyers was the simple fact that many officers were unaware of tank destroyer doctrine. Bruce had recognized this problem, and the Tank Destroyer Center started conducting indoctrination courses for senior officers on 30 November 1942.¹⁵ By then, many of the commanders who participated in the North African campaign had already departed the United States. In the final analysis, the sudden establishment of the tank destroyers in late 1941 did not allow time to disseminate the radical new doctrine throughout a rapidly expanding army.

However, ignorance of tank destroyer doctrine was not as important as the fact that many important commanders simply did not agree with the concept of tank destroyers. The Army had not reached a doctrinal consensus concerning antitank warfare. Although the Antitank Conference of 1941 had demonstrated that the bureaucracy was willing to accept the mobile tank-killers, the agreement of chiefs of branches and other important bureaucrats did not necessarily represent the views of the men who would command forces in the field. The chiefs of branches in 1941, generally an elderly lot, were never to command theaters or army groups. Misunderstanding of tank destroyer doctrine contributed to the opposition against tank destroyers. By 1943, General Bruce was " . . . distressed over the attitude of Generals Patton, Devers, Bradley, and

now Lucas."¹⁶

General Patton's objection to tank destroyers was simple: they should have been tanks. He would have preferred to replace tank destroyers with tanks.¹⁷ A good offense was always the best defense to Patton, and the tank destroyer was simply a poor tank. He believed that tanks could fill the need for mobile antitank guns while retaining the offensive capability of tanks.

Far more adamant than General Patton, General Devers disagreed with the whole concept of tank destroyers, disinterring the argument that had been institutionally buried by General Marshall in 1941. After his trip to North Africa, General Devers concluded that:

The separate tank destroyer arm is not a practical concept on the battlefield. Defensive antitank weapons are essentially artillery. Offensively, the weapon to beat a tank is a better tank. Sooner or later the issue between ground forces is settled in an armored battle--tank against tank. The concept of tank destroyer groups and brigades attempting to overcome equal numbers of hostile tanks is faulty unless the tank destroyers are actually better tanks than those of the enemy.¹⁸

General Devers represented a significant body of opinion within the US Army. In later years, his view would become doctrine.

Although their disagreement was less fundamental, the views of Generals Bradley and Lucas had a more direct impact on the tank destroyers. Although the idea of separate antitank battalions was palatable, they disagreed with self-propelled guns.

General Bradley was undoubtedly impressed by the effectiveness of the Germans' dug-in antitank guns in North Africa. The readily concealed German guns were effective and difficult to pry

out of their positions. By January 1943, General Bradley complained about the high silhouette of the self-propelled TD's and stated his preference for towed guns that could be dug in with only their muzzles above the ground.¹⁹

While generally in the same vein, the views of Major General J. P. Lucas were more adamant than General Bradley's. After observing the Sicilian Campaign, General Lucas commented in a report that:

The Tank Destroyer has, in my opinion, failed to prove its usefulness. I make this statement not only because of the results of this campaign but also after study of the campaign in TUNISIA. I believe that the doctrine of an offensive weapon to "slug it out" with the tank is unsound. I think that the only successful anti-tank weapon is one which has a purely defensive role, has high penetrating power and, such a low silhouette that it can be concealed, dug in, and hidden by camouflage. . . . I am of the opinion that the anti-tank weapon should be a towed gun of great power and low silhouette.²⁰

General Lucas' report was very influential and widely distributed in AGF. For example, while discussing a proposed rearmament of the M-10, Brigadier General John M. Lents, the G-3 of AGF, recommended informing the Ordnance Department that "The trend is toward towed guns (quote Seventh Army Report . . .)." ²¹

Successful use of towed antitank guns by both Allied and Axis forces in North Africa contributed to the pressure for American adoption of those weapons. German tactical skill with their anti-tank guns and the legendary "88" provided ample demonstration of the effectiveness of such weapons. British success with towed weapons was probably just as influential. Soon after the American Army's debacle at Kasserine, the British soundly defeated a German

thrust at Médenine. English 6-pounder antitank guns thwarted the German attack and destroyed over 40 Panzers.²² One American observer in North Africa commented that it was "The best job of tank destroying that has occurred in Africa"²³ Successful use of towed antitank guns generated pressure on the US Army to incorporate those weapons into its antitank system. Ironically, the failure of America's only towed antitank gun, the 37-mm, contributed to the pressure for improved guns and to the misuse of tank destroyers.

The doctrine of the tank destroyers assumed that infantry units could protect themselves from tanks and allow the TD's to remain in reserve, available to counter major penetrations. However, the ineffectiveness of the infantry's organic antitank gun, the 37-mm, meant that the foot soldiers could not protect themselves from tanks and morale sank. This put great pressure on commanders to allot tank destroyer units among the infantry units in order to give those units some protection from tanks.

There is no shortage of criticism of the 37-mm gun. A typical comment from Colonel Robert S. Miller, an observer, noted that:

Two general officers condemned this gun as useless as an anti-tank weapon and strongly recommended that it be discarded. They stated that it would not penetrate the turret or front of the German medium tank, that the projectiles bounced off like marbles, and the German tanks over-run the gun positions.²⁴

However, the same observer commented that the problems of the 37-mm gun were not all due to the gun's performance. After investigating, Colonel Miller discovered that infantry units were

not placing the weapons in concealed positions where they could engage the vulnerable flanks of German tanks. Thus the 37-mm was forced to fight the frontal armor of German tanks--something that no one had ever claimed it could do. Miller, an infantryman, recommended that the gun be retained in infantry battalions while training should stress proper employment.²⁵

Also contributing to the general disgust with the 37-mm, many units were using the wrong ammunition. General Barnes, who accompanied General Devers to North Africa, discovered that about 50 percent of the 37-mm ammunition was old, semiarmor-piercing (SAP) shot. Further, he found that the men of the units could not tell the difference between SAP rounds and capped ammunition, which was far superior. In addition, Barnes was unable to find any of the latest 37-mm ammunition in Africa--the new M-51 rounds that had increased velocity (from 2,600 fps to 2,900 fps), which made them much more potent.²⁶

Attempting to refurbish the image of the 37-mm, ordnance officers tested the gun with M-51 rounds against two captured German tanks. They found that the Mark III's front could be penetrated at 800 yards while its flanks were vulnerable at 1,000 yards. The Mark IV's front was penetrated at 400 yards and its flanks at 350 yards.²⁷ However, tests could not change opinions cemented by experience on the battlefield. As an observer concluded, "Confidence in the 37-mm gun as an antitank gun has been lost."²⁸

Dissatisfaction with the 37-mm gun led to a request from

General Eisenhower for the American version of the 6-pounder.²⁹ In production in the United States to meet British and Russian requirements, the 6-pounder, designated the 57-mm by the US Army, was readily available.³⁰ General McNair disagreed with issuing the 57-mm because it was less mobile than the 37-mm.³¹ Hoping to replace regimental antitank companies with a TD battalion equipped with 3-inch guns, McNair believed that 37-mm guns supplemented by bazookas would offer sufficient close-range protection for infantry battalions.³² However, the War Department disagreed and the 57-mm antitank gun became standard equipment for infantry divisions.³³

The 37-mm gun had been no more successful in the tank destroyer units than it had been in infantry units. Indeed, the weaknesses of the 37-mm was accentuated in the Fargo, because it was more obvious and was vulnerable to enemy fire. As one observer concluded, "The sending of such a patently inadequate destroyer into combat can at best be termed a tragic mistake."³⁴

Although far more successful than the Fargo, the M-3 received mixed reviews. One observer reported that the "Heartiest possible praise was given to the 75-mm gun SP as an effective anti-tank, or tank destroying weapon."³⁵ On the other hand, General Lucas condemned the M-3 because of its vulnerability.³⁶ Reports concerning the M-3's immediate replacement, the M-10, were more encouraging.

Combat revealed that the M-10 was clearly superior to the M-3, and the troops were satisfied with the new vehicle. Increased firepower and greater cross-country mobility were the main sources

for praise for the M-10.³⁷ The heavier armor and 360-degree traverse for the main gun also built confidence in the M-10, although the M-10 lacked the mobility to outrun medium tanks.

The effectiveness of their equipment proved to be the brightest aspect of the first experiences of the tank destroyer units in combat. With the exception of the Fargo, the guns of the TD battalions proved capable of destroying German tanks, but the advent of heavier German tanks would spur the development of heavier guns for tank destroyers.

The tactical employment of tank destroyers presented a less happy picture for the new units. Never given a fair test, the tactical doctrine of the tank destroyers was condemned nonetheless by important military figures such as Generals Bradley and Devers. Success at El Guettar could not outweigh the lack of success at Kasserine and other places. In contrast, the experiences of the British and the effectiveness of German antitank weapons generated pressure to change tank destroyer doctrine, organization, and equipment.

ENDNOTES

¹Final report of Major Allerton Cushman, dtd. 15 April 1943 (hereafter cited as Cushman Report), Intelligence Reports, Foreign Observer Reports, Folder 48, AGF files, RG 337, National Archives, p. 19, hereafter cited as AGF Obs.

²Report of Colonel Thomas J. Heavey, dtd. 19 February 1943, AGF Obs., Folder 1, p. 24, hereafter cited as Heavey Report.

³Ibid., p. 23.

⁴Cushman Report, p. 19.

⁵Heavey Report, p. 23.

⁶Cushman Report, p. 19.

⁷George F. Howe. Northwest Africa: Seizing the Initiative in the West (Washington, D.C.: OCMH), 1957, p. 434.

⁸The entire narrative of B/701st TD is extracted from Captain Gilbert A. Ellman, "Gafsa and Sbeitla," TD Combat in Tunisia, dtd. January 1944, Bruce, pp. 1-16.

⁹Report of Maj. Gen. C. P. Hall dtd. 7 May 1943, AGF Obs., Folder 49, p. 4.

¹⁰Howe, Africa, pp. 557-560 describes the general situation and has some details of the action.

¹¹Lt. Col. H. D. Baker, CO, 601st TD Bn., "El Guettar," TD Combat in Tunisia, dtd. January 1944, Bruce, pp. 17-18.

¹²Ibid., pp. 17-30. There is some confusion about the battle. Howe, Africa, claims that the 899th TD Bn. was involved but Baker does not mention this. The Cushman Report only says that a company of the 899th was sent to help.

¹³Ibid.

¹⁴Letter from Col. H. J. McChrystal to Bruce, dtd. 30 October 1943, Bruce.

¹⁵Study No. 29, p. 26.

- 16 Letter from Bruce to Pinky (Maj. Gen. Orlando Ward), dtd. 1 October 1943, Bruce.
- 17 George S. Patton, Jr., War as I Knew It (Boston: Houghton Mifflin Co., 1947), p. 220.
- 18 Devers Report.
- 19 Kent Roberts Greenfield, Robert R. Greenfield, and Bell I. Wiley, The Organization of Ground Combat Troops (Washington, D.C.: OCMH, 1947), p. 427.
- 20 Memo from Maj. Gen. J. P. Lucas to the Commander-in-Chief, dtd. 26 August 1943, AG 370.2, RG 407, National Archives, pp. 2-3, hereafter cited as Seventh Army Report. This report was widely distributed in AGF and sometimes referred to as Seventh Army Report.
- 21 Memo from G-3 to CG, dtd. 15 October 1943, AGF.
- 22 Howe, Africa, pp. 514-519.
- 23 Cushman Report, p. 14.
- 24 Report of Col. Robert S. Miller, dtd. 5 March 1943, AGF Obs., Folder 17.
- 25 Ibid.
- 26 "Ordnance Annex," Devers Report, p. 12.
- 27 Letter from Col. D. J. Crawford to the Chief of Ordnance, dtd. 9 April 1943, OHF.
- 28 Report of Maj. Gen. C. P. Hall, dtd. 7 May 1943, op. cit.
- 29 Robert R. Palmer, Reorganization of Ground Troops for Combat, Study No. 8 (Historical Section, AGF, 1946), pp. 22, 32, hereafter cited as Study No. 8.
- 30 Memo from Brig. Gen. I. H. Edwards to CG, AGF dtd. 26 January 1943 and memo from G-4 to RQTS dtd. 5 February 1943, both in AGF (472).
- 31 Study No. 8, p. 22.
- 32 Letter from McNair to Bruce, dtd. 2 January 1943, Bruce.
- 33 Study No. 8, p. 32.
- 34 Cushman Report, p. 6.

³⁵Heavey Report, p. 25.

³⁶Seventh Army Report, p. 3.

³⁷Cushman Report, pp. 1, 3.

CHAPTER 4

DOCTRINE AND DEVELOPMENT, 1943--1944

The results of combat actions in North Africa were quickly felt in the United States. Written doctrine had to be revised to incorporate combat experiences. One product of those experiences, towed guns, forced the Tank Destroyer Command to change its organizations to accept the new weapon. Adoption of towed guns also affected development since AGF wanted to increase the effectiveness of this type of weapon.

Developing better weapons continued to demand a great deal of attention from the Tank Destroyer Center. The Center persevered in supporting the T-70 and finally put that vehicle into production. Spurred by the appearance of heavy German tanks such as the Tiger and Ferdinand, the Army worked to get a heavier antitank weapon, the 90-mm gun, to the battlefield. Technical problems slowed and complicated development efforts. Not surprisingly, rewriting doctrine proved simpler than developing equipment.

The lessons of combat quickly created pressure to revise the doctrine of tank destroyers. Significantly, the lessons from the front were those perceived by men outside the Tank Destroyer Center. The officers at Fort Hood believed that tank destroyers had suffered from misuse and expedient equipment, not bad doctrine. However, the Center began revisions to modify their doctrine during the summer of 1943. As the Center's history indicates, "The

revision of FM 18-5 was undertaken to bring tank destroyer doctrine into conformity with the lessons of combat in Africa as interpreted by higher headquarters."¹

Apparently, the aggressive tactics of early doctrine for tank destroyers had irritated some important people. Emphasis on aggressiveness and offensive action in FM 18-5 was missing from its revision. The bold, colorful language of the field manual's 1942 edition was subdued and conservative by 1944. For example, the sentence, "Action of tank destroyer units is characterized by rapid movements, sudden changes in the situation, and a succession of brief but extremely violent combats separated by sporadic lulls," disappeared in the later edition.² In contrast, the 1944 version blandly comments that, "Action of tank destroyers is characterized by an aggressive spirit."³ Further, the tactics of fire and movement emphasized by the 1942 manual nearly disappears in the later text.⁴ While the 1944 edition was generally more subdued than its predecessor, some changes were more specific.

The constant attachment of tank destroyer battalions in North Africa to divisions or smaller units was reflected in the new manual. While the 1942 version only allotted 5 pages to the topic of supporting divisions, the 1944 edition devoted 21 pages to the subject, with diagrams. More significantly, the tank destroyers assumed the role of protecting friendly infantry by repelling the enemy's initial attack rather than his breakthrough, something which had been avoided in 1942.⁵ While the Tank Destroyer Center was willing to help units cope with the realities of tank destroyer

employment, the officers at Fort Hood were forced to make other changes to their doctrine.

Tank destroyers in North Africa were often accused of chasing or hunting tanks. This was a false criticism as far as General Bruce of the Tank Destroyer Center was concerned. He complained:

I believe that many reports from higher headquarters about tank destroyers chasing tanks are based on the fact that one platoon of three guns did attempt to chase tanks, the lieutenant commanding admitting his error.

Despite General Bruce's beliefs, the new field manual emphasized that, "Tank destroyers ambush hostile tanks, but do not charge nor chase them."⁷ The most drastic changes in doctrine resulted from the modification to include towed weapons, which were never in favor at Fort Hood. Reflecting the new weapons, FM 18-5 discussed appropriate doctrine for towed battalions.

In general, the employment of towed units was the same as that for self-propelled. The basic concept of mobile guns employed in mass remained the same. When towed battalions were addressed specifically, it was usually to mention their limitations. For example, while self-propelled companies could withdraw under fire, FM 18-5 cautioned that "Daylight withdrawals of towed units are likely to result in heavy casualties"⁸ Towed guns were deemed superior for advanced positions.⁹ This was probably due to the fact that a towed gun, dug-in, was less likely to be observed than a self-propelled weapon. Doctrine for towed units was based on experience with such units at Fort Hood.

The failure of the Cletrac had breathed new life into the

towed 3-inch gun. On 22 August 1942, AGF directed the Tank Destroyer Center to restudy the matter of towed mounts. Towed guns, noted AGF, could be unloaded at places where docking facilities were too limited to handle the 30-ton M-10. AGF pointed out that it contemplated organizing a number of towed battalions and therefore directed the Center to develop a tentative plan for a towed battalion.¹⁰

After studying the matter, General Bruce remained opposed to towed battalions. He believed that a towed battalion would require 300 more men than a self-propelled unit. He pointed out that a prime mover and gun required more shipping space than a self-propelled weapon. Instead of the towed gun, Bruce recommended adapting the M-3 so that its 75-mm gun could be shipped separately from the half-track. The half-track and gun could then be reassembled and employed until facilities were available to land heavier tank destroyers.¹¹ However, events from the field overruled Bruce.

In the light of comments from North Africa, on 1 January 1943 AGF directed the Center to test a towed tank destroyer battalion. Personnel of the 801st TD Battalion conducted extensive field tests during January and February, which resulted in a tentative organization on 12 March.¹²

Maintaining momentum, AGF ordered 15 self-propelled battalions converted to towed units on 31 March as a tentative measure for training. On 7 May, the War Department issued a table of organization for the towed battalion and officially authorized the new unit.¹³

The organization of the towed battalion was essentially the same as for the self-propelled unit. Elimination of one reconnaissance platoon and the inclusion of the remainder of those platoons in the headquarters company were the main adjustments. In addition, both the gun crews and the security sections were enlarged.¹⁵

While the creation of a towed battalion was probably the most significant organizational change for tank destroyers, the measure had been preceded by other changes. As a result of the AGF decision during July 1942 to convert all TD units to 3-inch guns, the Center submitted a table of organization on 9 November 1942 that substituted another heavy gun platoon for the light gun platoon in each company. The only battalions that employed the light platoons in combat were the first two units in North Africa.

On 12 November 1942, AGF directed the Center, along with all other commands subordinate to AGF, to reduce all organizations by 15 percent in personnel and 20 percent in motor transportation. The biggest cuts were made against administration and supply elements. Some tactical vehicles were eliminated, including the antiaircraft section of each platoon. The War Department published the new tables on 27 January 1943.¹⁶

While the adjustments to tables of organization forced by General McNair's "cutting board" proved to be digestible, the towed units remained a matter of controversy. A year after the War Department authorized the units, some officers still condemned the towed guns as "worthless," but the Tank Destroyer Board noted

that preferences for self-propelled over towed guns stood at about eight to five, about the ratio of units furnished to the theaters by the summer of 1944, justifying both types of organization.¹⁷

General McNair had resisted pressure to have all tank destroyer units converted to towed guns. He believed that the combat experiences of North Africa had not been conclusive concerning the matter. Unless further experience justified a change, General McNair remained convinced that both towed and self-propelled weapons should be supplied.¹⁸ After General McNair personally coordinated the matter with the War Department, the latter directed in November 1943 that half the battalions should be self-propelled and half towed.¹⁹ By that time, the process of converting self-propelled battalions in the United States to towed guns was well under way. An important part of that effort was devoted to the gun itself.

Faced with the reality of towed battalions, the Tank Destroyer Center began serious efforts to develop the 3-inch gun. The 3-inch gun had been standardized as the M-1 in December 1941, prior to the completion of service tests.²⁰ Despite standardization, service tests discovered many defects in the 3-inch gun. Although opposition to towed weapons from the Tank Destroyer Command had been the principal reason that the 3-inch gun was cancelled in the summer of 1942, SOS noted several deficiencies in the weapon and concluded that, "In general, [the] carriage is not properly designed to accommodate the gun."²¹ However, the failure of the Cletrac convinced AGF to ask for production of 500 3-inch guns on

23 August 1942.²² Lack of participation of the Tank Destroyer Center in the development of the 3-inch gun up to that time is evident from the fact that no example of the gun was shipped to Fort Hood until 25 August 1942.²³

The deficiencies of the M-1, 3-inch gun proved to be amenable to modifications. A new traversing mechanism cured one of the main problems of the prototype gun.²⁴ Other problems of the M-1, primarily a poor sight and excessive hop, were eliminated with field modifications that could be applied to completed guns, and the resulting weapon was standardized as the M-1A1.²⁵

Development work continued at Fort Hood through 1943. The Tank Destroyer Board went beyond correcting technical deficiencies and began adapting the gun to make it more suitable for tank destroyer tactics. Resulting from the work at Fort Hood, the M-6 was standardized in November 1943.²⁶ The most visible change was a large, sloping gunshield on the M-6. In addition, 10 other significant modifications were developed by the Tank Destroyer Board including firing segments and a trail castor.²⁷ By February 1944, AGF was impressed enough to comment that, " . . . the re-design of the 3" Gun Carriage M-1 into the 3" Gun Carriage M-6 has resulted in an excellent towed tank destroyer weapon."²⁸

One thousand M-1 guns had been manufactured before the M-6 was completed. AGF asked that all M-1's be converted to M-6's. In addition, AGF requested 500 more M-6's. The M-1's had to be modified at the factory, but ultimately all units going overseas were equipped with the M-6.²⁹ While the development and production of

the M-6 continued during 1943, ordnance engineers labored to put a heavier antitank gun into the field, the 90-mm.

Like the 3-inch gun, the 90-mm antiaircraft gun's ballistic characteristics made it a natural candidate as an antitank weapon. The higher velocity and heavier projectile that made the 90-mm gun a better antiaircraft weapon than the 3-inch gun also made it better for penetrating armor. However, the 90-mm gun was only beginning to reach antiaircraft units when America entered the war. Had the 90-mm gun been readily available, the 3-inch gun might never have been adapted for antitank use. In any case, there was early interest in the 90-mm gun as an antitank weapon.

Ordnance officers initiated the development of the 90-mm antiaircraft gun mounted on the M-4 tank chassis on 2 February 1942. Formally recognizing the project on 1 July 1942, the Ordnance Technical Committee recommended development of the vehicle designated the T-53, noting that "Reports from various sources have indicated the effectiveness of the German 88-mm aircraft (sic) gun when used as an anti-tank weapon." Intended to use a maximum of components already in production, the T-53 appeared to offer a way to get a self-propelled, 90-mm gun into production very quickly.³⁰

For its part, AQF directed the Antiaircraft Command on 25 July 1942 to study the problem of firing the 90-mm gun against ground targets. Finding that an average crew needed 5 to 10 minutes to emplace the gun with its single axle mount, the Antiaircraft Board concluded that the 90-mm gun was "undesirable" for use against

mechanized targets, but the T-2 gun mount then under development showed promise of delivering shorter emplacement times.³¹

Therefore, the T-53 appeared to be the only means available to use the 90-mm gun in an antitank role. Similar to the T-24 carriage for the 3-inch gun, the T-53 was an M-4 tank chassis with a shielded, 90-mm gun perched on top. Its high silhouette certainly limited its tactical usefulness. At a conference on 24 August 1942, representatives of AGF, SOS, and the Ordnance Department agreed to produce 500 of the vehicles despite the problems.³²

General McNair had already pointed out the superiority of the 90-mm over the 3-inch gun. He wrote to General Bruce in July that, " . . . there is a material advantage in the 90-mm so far as penetration is concerned. The trajectory seems a little flatter than that of the 3".³³ General Bruce quickly complained about production of the T-53 before tests at Fort Hood, commenting that, " . . . the vehicle is an expedient and entirely lacks many of the major military characteristics considered essential by the TDC, in fact is a step backward rather than forward." AGF retorted that, "It is the opinion of this Headquarters that the Tank Destroyer Board will find this gun mount an adequate anti-tank weapon."³⁴

Despite assurances from AGF, the Tank Destroyer Board was quick to condemn the T-53 after they received an example for tests. Following those tests in the fall of 1942, AGF agreed to cancel production of the T-53 although they believed that development of a self-propelled mount for the 90-mm gun should continue. However, the T-53 lingered until tests by the Antiaircraft Board convinced

that organization that they had no use for the weapon, either. The project was not terminated until 12 April 1944, and by that time a much more promising development was well advanced.³⁵

While the T-53 used the standard antiaircraft gun, it was obvious that adapting the gun to fit the turrets of tanks or tank destroyers would be more advantageous. Therefore, on 21 September 1942, Barnes directed his engineers to begin drawings of such an adaptation.³⁶ The Ordnance Committee approved the project on 1 October.³⁷

Ordnance engineers accomplished the task of making the 90-mm gun suitable for vehicles by adapting the gun to fit the recoil system of the vehicle-mounted, 3-inch gun. The process required several modifications including a new breech ring and machining down the outer surface of the tube.³⁸ Quickly accomplishing the necessary work, ordnance engineers mounted the gun in an M-10 tank destroyer and fired it by the end of December 1942.³⁹ Taking the next, obvious step, General Barnes recommended that the modified M-10 continue development as the T-71.⁴⁰

Objections to the T-71 appeared quickly. Apparently, General Bruce viewed the vehicle as just another expedient; an expedient made worse by the fact that he already disliked the M-10. However, ACF had already shown an interest in the development of the 90-mm gun for antitank purposes. Compromising, ACF agreed to the T-71 with the understanding that it was a development project intended only to secure information about the practicability of mounting the 90-mm gun on the M-10. Objections from Fort Hood

were obvious from the statement that:

The gun is not desired by the Tank Destroyers as a tank destroyer weapon since it is believed that the 3-inch gun has sufficient power. It is further felt that the Gun Motor Carriage, M-10, is too heavy and too slow.⁴¹

Despite the early success of the T-71, the project quickly met delays. Tests of the original mount which were ended in January 1943 proved that the vehicle was unsatisfactory, principally because of the basic faults of the M-10. The unbalanced turret of the M-10 became excessively so with the 90-mm gun, and the heavier gun made the lack of power traverse unacceptable. Therefore, ordnance engineers had to institute a complete development program for a new turret.⁴²

By May 1943, a wooden mockup of the new turret was completed in Detroit.⁴³ Enthusiastically, Colonel Joseph M. Colby, head of research and development at the Tank-Automotive Command, recommended in August that the T-71 be standardized even though metal prototypes were still incomplete.⁴⁴ The prototype of the T-71 finally arrived at Aberdeen, Maryland, in mid-September.⁴⁵

Armed with a prototype, Major General T. J. Hayes, acting Chief of Ordnance, requested production of 500 T-71's. However, Hayes lumped the request for T-71's with requests for production of a large number of experimental tanks which were the subject of heated controversy. Army Service Forces (ASF) reacted by refusing the whole request.⁴⁶

Apparently unhappy about the refusal to produce T-71's, General Barnes tried to cultivate acceptance of the vehicle. General Barnes contacted members of the Armored Command trying to

sell the T-71 and exhibited the vehicle to General Moore of AGF.⁴⁷ Favorable response from those parties encouraged Barnes to request production of from 500 to 1,000 T-71's on 4 October 1943.⁴⁸

Brigadier General W. F. Dean of the Requirements Section at AGF thought that "General Barnes' recommendation is considered to have considerable merit" Besides a superior fighting compartment and power traverse, General Dean mentioned that the T-71 weighed 3,900 pounds less than the M-10 since the new vehicle's turret eliminated the need for counterweights. In addition, he pointed out the superior ability of the 90-mm to destroy German tanks or pillboxes.⁴⁹

The superiority of the 90-mm gun was not the main reason that Dean recommended producing 1,000 T-71's. The measure would also use excess M-10 chassis and allow outbacks in the production of M-10's. The G3, Brigadier General John M. Lentz, agreed heartily, commenting that "We have more M-10's than we know what to do with" ⁵⁰

In the fall of 1943, AGF found itself with far more tank destroyer weapons than it could possibly use. This was primarily due to a sharp reduction in the number of projected tank destroyer battalions. While General McNair had wanted over 200 tank destroyer battalions in 1942, the War Department had only authorized 144. Since there was no great demand for tank destroyers from the theaters, McNair recommended in April 1943 that the program be reduced to 106 battalions. By October 1943 the War Department planned to cut the number to 64. After McNair objected, the War

Department settled on 78 battalions.⁵¹ Meanwhile, production of M-10's had continued during 1943 because there was no alternative weapon. In any event, AGF found itself in October 1943 with existing or projected production of 11,547 self-propelled tank destroyers, sufficient to equip over 200 battalions, versus a requirement for only 2,862.⁵²

Based on the fact that "We are over-producing on TD's," General Lentz would not recommend producing 1,000 T-71's. General Lentz believed that:

The mobility of the T-70 precludes going to the T-71 unless the added power of the 90-mm gun is essential. It is not at this time. Conditions might change. A few heavily armed units might find employment against fixed defenses.

Despite his misgivings, General Lentz concluded that, " . . . possible future developments of German armor, and the possible need for power against fortification, . . . warrant construction of a moderate number (300) of T-71's."⁵³ General McNair agreed but felt that they would not be amiss to raise the number to 500, enough for 10 battalions and a reserve, while ceasing production of M-10's.⁵⁴ Therefore, on 25 October AGF requested ASF to produce 500 T-71's and terminate the production of M-10's.⁵⁵

Despite the rapid approval of production for the T-71, the vehicle would not see action for nearly a year. Tests at Fort Knox revealed serious problems with the T-71 that necessitated time-consuming modifications.⁵⁶ However, the Tank Destroyer Board recommended that the T-71 "be considered suitable for use as a tank destroyer" after modifications.⁵⁷ Production of T-71's did not begin until April.⁵⁸ In June, the T-71 was standardized as the

M-36.⁵⁹ The M-36 was not the only project intended to provide a 90-mm gun for tank destroyers.

In the fall of 1942, General Barnes requested his engineers to initiate a design study of a towed antitank carriage for the 90-mm gun.⁶¹ Development of the weapon proceeded very slowly. The idea was not presented to the Ordnance Committee until 22 March 1943, when only a sketch of the proposed gun was available.⁶¹ Formal approval of the project came on 29 April 1943.⁶² The infancy of the project was emphasized by the AGF's comment to the Tank Destroyer Command that " . . . the studies are only in the first stages of development" ⁶³

The lack of progress is somewhat surprising, since the Ordnance Department was not proposing a major development program. Ordnance sketches envisaged modifying the carriage and recoil system of the M-2, 105-mm howitzer, to mount the 90-mm gun. Protection for the carriage would be provided by adapting the gunshield of the M-6, 3-inch gun.⁶⁴ This apparently straightforward adaptation proved to be very difficult for ordnance engineers.

Immediately following the Ordnance Committee's approval of the project, the Ordnance Department contracted with the Link-Belt Company to design the gun.⁶⁵ By November, the manufacturer was complaining that completion of the design was delayed because a subcontractor had failed to deliver gunshield designs.⁶⁶ The Ordnance Department caused more delay by ordering numerous design changes, including completely new trails.⁶⁷ Despite delays, Link-Belt managed to deliver a complete gun to Aberdeen, Maryland, in

January 1944.⁶⁸

Apparently pleased with their progress, the Link-Belt Company reported in January that they could begin production during June. Tests at the proving ground quickly dampened their optimism.

Tests by the Ordnance Department revealed some serious defects. The resulting changes, including new trails and a change in the position of the axle, caused a redesign and a change in designation to T-5E1.⁶⁹ By May, Link-Belt had delivered another gun to Aberdeen.⁷⁰ Discovery of 38 defects, primarily unsatisfactory recoil characteristics, caused further redesign.⁷¹

Meanwhile, pressure was building to get the gun into production. General McNair witnessed a demonstration of the T-5E1 on 2 May and was apparently impressed.⁷² General McNair's visit was followed shortly by a request for completion of the design and production of 600 guns " . . . at the earliest possible date."⁷³

AGF had been interested in the 90-mm antitank gun for some time. During October 1943, General Moore called General Barnes about a 90-mm towed mount and was assured that " . . . we are pushing it."⁷⁴ On 2 November 1943, AGF had submitted their own military characteristics for a towed 90-mm gun.⁷⁵ Responding, the Ordnance Department extended the T-5 program to include the desires of AGF.⁷⁶ AGF's request included the addition of a "blast deflector (muzzle brake)."⁷⁷ This item had not been a component of the T-5 and was to cause some controversy.

The Ordnance Department did not ignore the desires of AGF.

During June, they instituted a design program to adapt the T-5 for a muzzle brake.⁷⁸ The dispute arose after General McNair witnessed a firing test that compared the gun with and without a muzzle brake. Ordnance officers apparently believed (erroneously) that General McNair dropped the requirement for a muzzle brake after this test. In their clarification of the requirement on 14 July 1944, the AGF comment that "The Ord/Dept alleges . . . the requirement . . . was withdrawn . . ." indicated the acrimonious nature of the dispute.⁷⁹ In defense of the Ordnance Department, the addition of a muzzle brake to the end of the 90-mm gun tube, in effect a long, moment arm, drastically changed the balance of the weapon and thus the characteristics of the carriage. Amid the controversy over muzzle brakes, the checkered career of the T-5 continued.

Hopes of AGF for early production of the T-5 were soon dashed. During July, tests of the latest version of the gun, without a muzzle brake, revealed serious problems with the carriage. Of some 30 problems, the most serious were a broken axle and cracks in the trails. As a result, representatives of AGF, ASF, and the Ordnance Department held a meeting to discuss the future of the T-5. AGF elected to reduce their immediate requirement to 200 guns while holding production of the remaining 400 guns in abeyance until a decision could be reached on exactly what type of gun should be produced.⁸⁰ Ordnance officers elected to design a completely new carriage to meet AGF requirements.⁸¹

The problems experienced with the T-5 during July 1944 are a good example of the hidden, technological pitfalls that plague the

development of virtually any weapon. An error in design computation caused the broken axle, but the cracks in the trails were due to poor steel. Hurrying to complete the prototypes, the Link-Belt Company used metal from the Inland Steel Company instead of their preferred supplier, Carnegie Steel. It seemed that Inland steel had a lower impact value (more brittle) than Carnegie steel. The result was cracked trails.⁸² Appearance of such problems some 6 months after completion of the first prototype accentuates the technological difficulties of developing weapons.

The ultimate result of the T-5's technical problems was a long delay in production. Instead of the Link-Belt Company's optimistic prediction of production in July 1944, production of the final version of the gun, the T-5E2, did not begin until December 1944.⁸³ While the Ordnance Department struggled with the problem of mounting the 90-mm gun on two wheels, the weapon designed by the Tank Destroyer Center, the T-70, progressed rapidly.

Shortly following the Palmer Board, the Ordnance Committee approved the development of the T-70 on 4 January 1943 and approved the production of six pilot models.⁸⁴ Orders for production quickly increased. Uncharacteristically, AGF requested production of 1,000 T-70's only 2 days later.⁸⁵ AGF rarely requested production of any major item of equipment before a prototype existed and preferred to wait until service tests were completed. Justifying its action, AGF commented that:

It is recognized that all of the modifications have not as yet been tested, however, the lack of a satisfactory tank destroyer gun motor carriage makes imperative the expediting of the production of the Gun Motor Carriage, T-70.⁸⁶

Apparently, AGF was trying to support General Bruce who continually complained about expedients and the lack of a suitable tank destroyer. However, some disharmony over the T-70 marred the relationship between AGF and the Tank Destroyer Center.

Trying to build the best vehicle possible, the Tank Destroyer Center wanted to continue improving the design as studies progressed. On the other hand, AGF believed that the design should be frozen as quickly as possible in order to start production. As General Moore commented in reaction to some changes proposed by the Tank Destroyer Center, "I think Bruce should be given emphatic instructions to finalize the design of this vehicle at once." General McNair settled the problem during a telephone conversation with General Bruce. General Bruce assured General McNair that the proposed changes were only inquiries and any recommendations for modification would be coordinated with the latter's headquarters.⁸⁷ It was not surprising that a vehicle placed into production so hastily would require many changes.

When the first pilot models reached Fort Hood, there were serious problems. Most important, the T-70 could not negotiate a 60-percent slope because the engine was underpowered and the torquomatic transmission slipped excessively. Installing a more powerful engine and modifying the transmission allowed the T-70 to meet minimum requirements.⁸⁸

Despite problems, the T-70, enthusiastically named Hellcat by the Tank Destroyer Center, went into production during the fall of 1943. Service tests of the production vehicles revealed a host

of new problems. Among the most serious faults, the starter was undependable, and there were various weak points in the suspension. As the defects were revealed, the manufacturer applied modifications to vehicles still on the production lines.⁸⁹ As production continued while more and more modifications became necessary the earliest vehicles grew increasingly obsolete. By early 1944, the situation was chaotic. There were over 1,000 T-70's in existence in varying states of modification.

To settle the matter, the Ordnance Department hosted a meeting on 5 February 1944 with representatives of the Ordnance Department, AGF, and the General Staff present. The men agreed that vehicles below serial number 658 would be returned to the factory for modification, and the remainder would be modified in the field.⁹⁰ On 17 February 1944, the T-70 was standardized as the M-18. When the M-18 was standardized, 1,200 had been produced, and a total of 1,097 of them required modification to meet the characteristics of the standard vehicle.⁹¹

The M-18's that were available did not go immediately into action. The War Department offered 40 M-18's to the European Theater of Operations (ETO). They were refused, because the theater did not want to reequip units at that time. The North African Theater of Operations (NATO) accepted 40 for shipment in March. However, most of the M-18's went to 14 tank destroyer battalions training in the United States.⁹² Thus, they would reach the front as the new battalions were deployed.

Despite the problems involved in arriving at a satisfactory

design for the M-18, the development program of the Hellcat was phenomenally good. In just over 2 years, the M-18 sped from conception to standardization. That record is better than any other armored fighting vehicle produced by the United States and is probably better than any produced by any other country. Rated at 50 miles per hour, the M-18 was the fastest tracked combat vehicle in any army, and it pioneered such important features as torsion bars and the torquomatic transmission. However, Bruce's worries about tank destroyer doctrine being discredited before the proper weapon became available proved to have some foundation.

The results of tank destroyers in the early days of the war, inhibited by expedient equipment and misemployment, resulted in changes to tank destroyer doctrine, organizations, and equipment. The changes were unwanted by the Tank Destroyer Center. Doctrine became less aggressive and had to cope with the desires of field commanders to disperse tank destroyers among small units and protect infantry. Towed guns, an anathema to Bruce, became standard equipment, but the Tank Destroyer Center improved the weapon for their use after the decision was final, resulting in the M-6, 3-inch gun. Pressure for heavier weapons, believed unnecessary at Fort Hood, resulted in the retention of the hated M-10 in a 90-mm gun version, the M-36. Attempts to obtain a heavier towed gun involved the Ordnance Department, AGF, and the Tank Destroyer Center in the development of a weapon, the T-5 90-mm gun, which exhibited all the tribulations of technological development.

After all the difficulties of doctrinal change and tech-

nological development during 1943 and early 1944, tank destroyers were finally receiving the weapon they desired to implement their doctrine. Along with the rest of the US Army in Europe, tank destroyers were about to meet their major test, the German Army in France.

ENDNOTES

¹Study No. 29, p. 35.

²FM 18-5, 42, p. 8, and War Department, FM 18-5, Tactical Employment: Tank Destroyer Unit, 18 July 1944, hereafter referred to as FM 18-5, 44.

³FM 18-5, 44, p. 5.

⁴In FM 18-5, 42, p. 20, paragraph and several later references are devoted to fire and movement while FM 18-5, 44, p. 59 uses the term only once.

⁵FM 18-5, 42, pp. 107-112 and FM 18-5, 44, pp. 72-93.

⁶Letter from Bruce to McNair, dtd. 5 June 1943, Bruce.

⁷FM 18-5, 44, pp. 5, 76-79.

⁸Ibid., p. 57.

⁹Ibid., p. 6.

¹⁰Letter from HQ, AOF to CG, Tank Destroyer Center, dtd. 22 August 1942; quoted in "Heavy Antitank Carriages," April 1944, OHP.

¹¹Letter from Bruce to CG, AOF, dtd. 9 October 1942, AOF (472.1).

¹²Study No. 29, p. 30.

¹³Ibid.

¹⁴TDC Hist. I, Chap. I, p. 30.

¹⁵Ibid.

¹⁶Ibid.

¹⁷TDC Hist. III, Chap. II, p. 4.

¹⁸Letter from McNair to Bruce, dtd. 11 June 1943, Bruce.

¹⁹Greenfield, Organization, p. 427.

²⁰OCM, item 17545 dtd. 7 November 1941 with indorsement from the War Dept. dtd. 10 December 1941, in "History of the 3-inch Gun Carriage M1, M1A1 and M6," OHF. This history can best be described as an office journal titled a chronology and a collection of pertinent documents such as the OCM item mentioned above. Hereafter, the document collection will be referred to as 3-inch Hist. The chronology will be referred to as 3-inch Chron. followed by the date of the entry in the chronology, e.g. 3-inch Chron., 1 January 1943.

²¹Letter from HQ, SOS to Chief of Ordnance, dtd. 26 July 1942, 3-inch Hist.

²²Letter from HQ, AGF to CG, SOS, dtd. 23 August 1942, 3-inch Hist.

²³3-inch Chron., 25 August 1942.

²⁴3-inch Chron., 27 August 1942.

²⁵OCM item 22132, dtd. 18 November 1943, appended to "Heavy Antitank Carriages," April 1944, OHF.

²⁶Ibid.

²⁷Study No. 29, pp. 65-67.

²⁸3-inch Chron., 1 February 1944.

²⁹"Heavy Antitank Carriages," op. cit., pp. 3-4.

³⁰OCM, item 18495, dtd. 1 July 1942.

³¹Letter from AGF to CG, Antiaircraft Cmd., dtd. 25 July 1942 and 2d indorsement from Antiaircraft Bd. to CG, Antiaircraft Cmd., dtd. 19 August 1942, AGF (472).

³²OCM, item 18726, dtd. 26 August 1942.

³³Letter from McNair to Bruce, dtd. 10 July 1942, Bruce.

³⁴Letter from HQ, AGF to CG, TDC, dtd. 11 September 1942, AGF (472). The "Memo for record" portion of this letter quoting a letter from Bruce dtd. 1 September 1942 is the source of Bruce's comment.

³⁵OCM, item 23745, dtd. 12 April 1944.

³⁶"Chronology," History of the 90-mm Gun Motor Carriage, T-71 (M-36) entry for 21 September 1942, hereafter cited as M-36 Hist. This document is similar to the 3-inch Hist. and will be cited the same way.

³⁷OCM, item 21210, dtd. 10 July 1943.

³⁸Ibid.

³⁹M-36 Chron., 10 December 1942 and 28 December 1942.

⁴⁰OCM, item 19845, dtd. 13 January 1943.

⁴¹Ibid. Memo from HQ, AGF to the Ordnance Committee, dtd. 9 February 1943, is an appendix to this OCM item.

⁴²OCM, item 22129, dtd. 8 November 1943.

⁴³M-36 Chron., 10 May 1943.

⁴⁴M-36 Chron., 10 August 1943 and 23 August 1943.

⁴⁵M-36 Chron., 13 September 1943.

⁴⁶Letter from CG, Armd. Cmd. to AGF, dtd. 1 September 1943, AGF (470.8); 3d Ind., letter from Hayes to HQ, ASF, dtd. 13 September 1943, M-36 Hist.; and memo from HQ, ASF to Chief of Ordnance, dtd. 16 September 1943, M-36 Hist.

⁴⁷M-36 Chron. 21 September 1943, 22 September 1943, and 24 September 1943.

⁴⁸Letter from Barnes to CG, ASF, dtd. 4 October 1943, M-36 Hist.

⁴⁹Memo from Repts. 1 to G-3, CG, dtd. 9 October 1943, AGF (470.8).

⁵⁰Ibid. and Memo from G-3 to CG, dtd. 15 October 1943, AGF (470.8).

⁵¹Greenfield, Organization, pp. 427-428.

⁵²Memo from Armd. Branch, G-3 Section to G-3, dtd. 12 October 1943, AGF (470.8).

⁵³Memo from G-3 to CG, dtd. 15 October 1943, op. cit.

⁵⁴Memo from CG to C of S, dtd. 22 October 1943, AGF (470.8).

⁵⁵Letter from HQ, AGF to CG, ASF (2d Ind. to Barnes' letter of 4 October), dtd. 25 October 1943, AGF (470.8).

⁵⁶M-36 Chron., 6 January 1944 and 17 January 1944.

⁵⁷M-36 Chron., 19 February 1944.

⁵⁸M-36 Chron., 10 April 1944.

⁵⁹OCM, item 24985, dtd. 29 August 1944.

⁶⁰"History of the 90-mm Gun (AT), T5E2," OHF, entry for 15 September 1942, hereafter cited as T-5 Hist. This document is similar to the 3-inch Hist. and will be cited the same way.

⁶¹OCM, item 20126, dtd. 22 March 1943.

⁶²T-5 Chron., 29 April 1943.

⁶³Letter from HQ, AGF to CG, TDC, dtd. 18 April 1943, AGF (472).

⁶⁴Ibid.

⁶⁵Ibid.

⁶⁶Letter from Link-Belt Co. to Mr. G. W. Sullivan, Ord. Dept., dtd 4 November 1943, T-5 Hist.

⁶⁷Letter from Maj. S. F. Musselman to Chicago Ord. Off., dtd. 6 January 1944, T-5 Hist.

⁶⁸T-5 Chron., 18 January 1944.

⁶⁹T-5 Chron., 19 February 1944.

⁷⁰T-5 Chron., 4 April 1944.

⁷¹T-5 Chron., 17 May 1944 and letter from Ord. Research Center to ASF, Ord. Off., dtd. 10 May 1944, T-5 Hist.

⁷²Letter from Ord. Research Center to ASF, Ord. Off., dtd. 8 May 1944, T-5 Hist.

⁷³Letter from HQ, AGF to CG, ASF, dtd. 15 May 1944, T-5 Hist.

⁷⁴"Activities of Maj. Gen. G. M. Barnes," OHF, 1 October 1943. This is a daily record signed by Barnes. Although the official histories refer to this as the Barnes Diary it is really not a diary since it contains no personal information.

⁷⁵Letter from HQ, AGF to CG, ASF, dtd. 2 November 1943, AGF (473.1).

⁷⁶Letter from Off. of Chief of Ord. to CG, ASF, 2d Ind. to letter above, dtd. 8 February 1944, AGF (473.1).

⁷⁷Letter from HQ, AGF to CG, ASF, op. cit.

⁷⁸T-5 Chron., 2 June 1944.

⁷⁹"Memo for record," appended to letter from HQ, AGF to CG, ASF, dtd. 14 July 1944, AGF (473).

⁸⁰Letter from HQ, AGF to CG, ASF, dtd. 2 August 1944, AGF (473) with inclosure "Deficiencies, 90-mm Gun Carriage T-5E1 as developed during tests at Aberdeen Proving Ground, 20 July 1944."

⁸¹Letter from Ord. Off. to CG, ASF, dtd. 2 August 1944, AGF (473), 2d Ind. to letter above.

⁸²Record of telephone call from Mr. Martin, Link-Belt Co. to Gen. Wells, Ord. Dept., dtd. 25 July 1944, T-5 Hist.

⁸³T-5 Chron., 31 October 1944.

⁸⁴OCM, Item 19438, dtd. 4 January 1944.

⁸⁵Letter from HQ, AGF to CG, SOS, dtd. 6 January 1943, AGF (473).

⁸⁶Ibid.

⁸⁷Letter from Brig. Gen. J. Christmas, Tank-Auto. Center to CG, SOS, dtd. 15 February 1943 accompanied by AGF memo slip with entries RQT to CG, dtd. 22 February 1943 and CG to RQT, dtd. 23 February 1943, AGF (473). Parenthetically, an interesting point in Christmas' letter points out the willingness of manufacturers to engage in a little war-profiteering. The transmission manufacturer (unnamed by Christmas) demanded 176 machine tools, extremely critical items, but settled for 9 after being informed that an alternate manufacturer existed.

⁸⁸Maj. D. L. McCaskey, "The Role of Army Ground Forces in the Development of Equipment," Study No. 34. Historical Section, AGF, 1946, p. 65, and TDC Hist. II, Chap. II, p. 3.

⁸⁹Ibid. and letter from Tank-Auto. Center to Chief of Ord., dtd. 7 December 1943, AGF (473).

⁹⁰Letter from Chief of Ord. to CG, ASF, dtd. 15 February 1944, AGF (473).

⁹¹Letter from Maj. Gen. S. C. Henry, New Developments Division, to Deputy Chief of Staff, U.S. Army, dtd. 23 February 1944, Records of the Chief of Staff, RG 165, file no. 470.8, National Archives, hereafter referred to as C/S.

⁹²Ibid.

CHAPTER 5

COMBAT IN NORTHWEST EUROPE

The experiences of the American Army in Europe would ultimately cause the abandonment of the tank destroyers. After an attempt to use tank destroyer doctrine, the Army ignored that doctrine because of tactical circumstances and refused to reinstitute the doctrine when circumstances changed. The complacency of the Army before D-day about German tanks would be replaced by intense concern after American units encountered them in combat. The Army was to be unpleasantly surprised about the limitations of its antitank weapons, including tank destroyers, when facing German armor.

Tank destroyer battalions were part of the forces being massed in England during the first months of 1944 for the invasion of France. By 23 March, there were 19 TD battalions in England, 16 self-propelled and 3 towed. Ultimate plans intended to redress the balance of towed and self-propelled weapons, calling for 50 percent of each type. By the time the invasion was launched, there were 19 self-propelled battalions equipped and ready for combat and 11 towed units.¹

The number of tank destroyer battalions planned for the overall campaign following the invasion indicated a declining concern for the German tank forces that had seemed so awesome in 1941. Originally, the plan called for 72 tank destroyer battalions. By

November 1943, General Bradley approved reducing the number to 52.²

Less concern about German armor was also evident in requests from the European Theater for the armament of future tanks. In May, Brigadier General Joseph A. Holly advised the G3 of ETO that armored vehicles were low on the priority list of probable targets for Allied tanks, fifth behind personnel, machineguns, artillery, and soft vehicles. For production in 1945, Holly wanted tanks with 90-mm guns and 105-mm howitzers in the ratio of one to three. The 105-mm howitzer, then available in the M-4 tank, was deemed an effective weapon against most of the probable targets, while a limited number of 90-mm guns would compensate for the howitzer's lack of "hole punching" ability.³ Lack of concern for German tanks was also evident in ETO's decision not to issue M-4 tanks with 76-mm guns prior to the invasion. Combat commanders deemed that the lack of time to train crews with the new tank and obscurity caused by the 76-mm gun's muzzle blast were " . . . an excessive price for the additional inch of armor penetration obtained."⁴

Even though General Holly asked for 90-mm guns, the need for those guns to deal with heavy German tanks was apparently not a matter of immediate concern. In response to a War Department query in May 1944, General Eisenhower mentioned training requirements and concluded that "No T-71's are desired at this time for converting Bns now under our control."⁵ While the state of training of invasion forces was of course very important by May 1944, Eisenhower's refusal of tank destroyers with the 90-mm gun indicates that he felt no pressing need for the gun. All theater

commanders agreed that they would rather receive trained units equipped with new weapons than attempt to reequip units in the field.⁶

Prior to the invasion, towed tank destroyer battalions began to fall short of expectations. Planners had hoped to attach a towed battalion to each division while retaining self-propelled battalions as corps or army reserves. This solution partially agreed with doctrine in FM 18-5 since it compensated for the lesser mobility of towed guns. Amphibious exercises prior to the invasion revised planning by revealing the vulnerability of towed weapons while unloading and going into action. Therefore, only one towed battalion was present in the initial invasion while several self-propelled units were used.⁷

After the invasion, the limitations of towed guns became more evident. Shortly following D-day, divisions that had not been in the initial landings began requesting self-propelled tank destroyers to replace towed units because of:

(1) the organic need for an armored self-propelled assault gun in the infantry division; (2) the inability of the towed gun to shoot direct fire over the hedgerows; (3) the thin armor of the towed gun which made it impossible to push it far enough forward to take advantage of the small field of fire defined by the hedgerows; and (4) the immobility of the towed gun once emplaced.⁸

Originally, the invasion plans called for a tank destroyer group to be attached to each corps and to control varying numbers of TD battalions as the armor threat might dictate.⁹ This idea was exactly the doctrine recommended by FM 18-5. However, the Normandy countryside, compartmented by hedgerows—each one a tank

obstacle—was poorly suited for the employment of large numbers of tanks. Most of the Panzer divisions became committed against the British further to the east, and as a result, German tank attacks involved only small numbers of tanks and aimed at limited objectives. This created pressure to disperse tank destroyers among frontline units rather than leave them concentrated in reserve positions to counter penetrations. Consequently, tank destroyer battalions were rarely attached to groups " . . . because of . . . the piecemeal employment of German armor." The various group headquarters quickly became advisory groups " . . . interested in seeing that the tank destroyer battalions were adequately supplied and gainfully employed."¹⁰ The concept of massing tank destroyers succumbed to the tactical situation and would not be revived even when needed.

Shortly after the breakout at St. Lo, a tactical situation occurred that begged for the employment of massed tank destroyers. Such massing never occurred.

During the first days of August 1944, American units were pouring through the gap that had been opened at St. Lo. Hoping to stem the tide and cut off a large American force, Hitler ordered an attack against the chokepoint of Avranches (See Maps 3 and 4). For the attack, the Germans assembled two corps which included four Panzer divisions.¹¹ Fortunately, the Allies were warned of the attack by Britain's Ultra organization which decoded German messages throughout the War.¹² Despite the warning, tank destroyers were not massed to defeat this threat of a large force of German armor. Instead, the 30th Infantry Division and its attached tank destroyer

unit, the 823d TD Battalion with 36 towed guns, would meet the brunt of the German attack.

On 5 August 1944, the 30th Infantry was attached to VII Corps and ordered to relieve the 1st Infantry Division in the vicinity of Mortain.¹³ Typically, the division ordered the 823d to attach each of its companies to a regiment of the division.¹⁴ Receiving no intelligence that the sector was anything but quiet, the 823d generally occupied the same positions as the previous tank destroyer unit. Unfortunately, some of the positions were exposed and lacked protection from infantry units.¹⁶ Thus, when the German attack came on 7 August, it found the 823d dispersed, unprepared, and in some cases unsupported.

Receiving only 20 minutes warning from the 30th Infantry Division, the 823d came under attack during the first hour of 7 August. By daylight, the German attack was well underway.¹⁷ The third platoons of both A and B Companies were in exposed positions. A Company's Third Platoon, unprotected by American infantry, quickly succumbed when German troops swept around their positions and made the guns untenable because of fire from small arms.¹⁸ The platoon from B Company fared little better. Although that platoon was able to kill two German tanks, "The heavy towed tank destroyer guns were sitting ducks when they revealed their locations by firing."¹⁹ Although other units of the 823d were more fortunate, the situation in the 30th Division's sector was very serious. As the unit's historian noted, " . . . with a heavy onion breath that day the Germans could have achieved their objec-

tives."¹⁹ Still, by the end of the day, American lines had generally held.

Although the 823d was generally successful, it took heavy losses. By the end of 7 August, the battalion had lost 11 guns with their prime movers (halftracks), three soldiers were dead, and 101 were missing. For their part, the tank destroyers had killed about 15 German tanks.²⁰ Most of the losses came from the two platoons that had been overrun in their exposed positions.

One incident on 7 August clearly illustrates the difficulties created by commanders who would not allow the tank destroyers to operate as a battalion. At about 0630 hours, the division ordered the 823d to move TD's to cover the southern flank "at once." After the battalion commander reminded the division that he had not a single tank destroyer under his control, the division gave him a platoon from C Company, which was not in contact with the enemy. However, the 119th Infantry regiment refused to release the platoon until noon.²¹ Fortunately, the delay did not prove to be critical since the Germans did not materialize in the south.

The attack continued for several days, but after 7 August German thrusts became progressively weaker. By 11 August, the German pressure was nearly gone; and on 14 August, American units began to advance.²² Although the 30th Infantry and the 823d TD Battalion were vital elements in the defeat of the attack, Allied air power was probably just as important in stopping the Germans.

One surprising aspect of the 823d's experience at Mortain was the fact that the TD's apparently had little trouble killing

the Germans' Panther (Mark V) tanks. Apparently, skilled employment of individual platoons and guns enabled the TD's to get shots at the vulnerable flanks of the Panther whose frontal armor had already proved impervious to the 3-inch gun.

Apparently aggravated by the tough hide of the Panther tanks during the first weeks of the Normandy campaign, the First Army set about finding exactly what weapons could kill that tank. A board of officers moved a Panther to a suitable location and fired at it with virtually every weapon in the First Army, including rifle grenades, 40-mm antiaircraft guns, and 105-mm howitzers. The results were disheartening. Only the 90-mm gun and the 105-mm howitzer proved capable of penetrating the Panther's frontal armor. However, the low velocity of the 105's HEAT ammunition made it nearly impossible to get hits with that weapon beyond 500 yards. The 90-mm was credited with penetrating the Panther's front from 800 yards.²³

When advised of those results, General Eisenhower was shocked:

Why is it that I am always the last to hear about this stuff? Ordnance told me this 76 would take care of anything the German had. Now I find you can't knock out a damn thing with it.²⁴

General Eisenhower quickly took action to rectify the situation. He dispatched General Holly with a letter for General Marshall demanding tanks and tank destroyers with 90-mm guns. General Marshall expedited shipment of M-36's and pointed out that a new tank with the heavy gun would be available soon.²⁵

The main reaction in the United States was an increase in

the production of M-36's. Initial production of the M-36 had already been increased from 500 to 900, primarily for the Army's strategic reserve. As a result of General Eisenhower's letter, the War Department's G4 authorized total production of 1,400 M-36's.²⁶ However, this was of no immediate help to General Eisenhower, who had exhibited such surprise concerning the results of the First Army's firing tests.

The reason behind General Eisenhower's surprise was that the US Army's technical intelligence, a responsibility of the Ordnance Department, had failed to adequately compare the effectiveness of America's antitank weapons against the armor of German tanks, particularly the Panther. There were two major elements in this failure. First, the effectiveness of the 3-inch gun, and thus the 76-mm gun, was greatly overestimated. Second, no one properly assessed the protection offered by the Panther's angled (55-degree), frontal armor.

Overestimation of the 3-inch gun was firmly established by 1944. While justifying a heavier weapon in March 1943, the Ordnance Committee had claimed that the 3-inch gun could penetrate the face of a Mark VI (Tiger) at 1,000 yards.²⁷ Later that year, the Commanding General of the Armored Command optimistically observed that the 76-mm gun could penetrate the Mark VI at 1,400 yards.²⁸ In stark contrast, soldiers in combat saw both 76-mm and 3-inch shells bounding off Tigers. A report from Italy mentioned the 3-inch gun versus the Mark VI, saying "While penetration of frontal armor has been effected at a range of 50 yards, it is believed in general the

3" gun is ineffective against the front armor of the Mark VI."²⁹

American intelligence never assessed the protection of the Panther (Mark V) despite the fact that the Army had all pertinent details of the tank by the fall of 1943. In the Armored Command's letter mentioned above, the Panther is conspicuously absent. But in a memo discussing a new American tank on 18 October 1943, General Dean accurately laid out the details of the Panther including the thickness of its hull front (3 and 5/16 inches at a 57-degree angle). General Dean believed, however, that future German production would emphasize the Tiger.³⁰ Apparently by May 1944, Allied intelligence corrected Dean's assessment of production, since General Holly emphasized the Mark IV and Mark V as the most important German tanks.³¹ Despite this, firing tests in England that same month compared England's 17-pounder against various American guns using slabs of armor angled at 30 degrees.³² Apparently the English were also unaware of the increased protection that the Panther accrued by having its armor angled at 55 degrees.

Even after the First Army tests revealed the inability of the 3-inch gun to penetrate the Panther, the Ordnance Department remained unconvinced. On 5 July, General Campbell cabled General Eisenhower that the "Panther Tank is generally less heavily armored than Tiger Tank" Despite the tests in France, Campbell claimed that the 76-mm gun would penetrate the Panther's turret at 1,000 yards while the 90-mm could penetrate the hull at 1,600 yards and the turret at 2,500 yards.³³ Eisenhower's reaction to this cable is unknown.

It is difficult to explain why the Ordnance Department had not assessed the effectiveness of the Panther's armor. Ordnance officers and, indeed, many officers outside the Ordnance Department were aware of the benefits of angled armor. The angular shape of the M-10 gives sufficient proof of that awareness. Still, Campbell seemed convinced in July 1944 that the Panther was less heavily armored than the Tiger. In fact, the thinner, angled armor of the Panther had a greater effective thickness than the Tiger's nearly vertical armor against flat-trajectory weapons. The conclusion is inescapable that the Ordnance Department was, at best, guilty of a major oversight. In their defense, it is obvious that ordnance officers were not the only ones to ignore the matter, but they were obliged to take the blame. At least the Ordnance Department had managed to have a self-propelled version of the 90-mm gun in quantity production by D-day.

If there is a lesson in all of this, it is that antitank weapons should be tested against captured enemy material, or at least the closest possible equivalent. Theoretical penetration data from a proving ground can be very misleading. In addition, the morale of the soldiers who must fight enemy armor is raised far more by the sight of holes in an enemy tank than by sterile data. Such testing must be accomplished early, because technological development requires time to cope with problems. The Americans fighting in Europe in 1944 had to wait months for a solution to heavy German tanks.

Although General Marshall had ordered that M-36's be shipped

during July, the new vehicle would wait some time before entering combat. The new tank destroyers did not reach the hands of troops until September-October 1944.³⁴ The delay was probably due to two factors, the time required for the sea voyage and the tactical situation at the end of the voyage. Shortly after the First Army tests, the American Army broke out of the confines of Normandy and began an exploitation that soon made tactical problems subordinate to logistical difficulties. Any combat commander in France during August and September 1944 would have probably preferred to see 30 tons of gasoline arrive in his area rather than 30 tons of tank destroyer.

In addition to the gradual shift toward heavier guns, the fall of 1944 also saw a move away from towed weapons. By September, ETO began requesting more self-propelled units. After coordinating with the War Department, ETO decided to begin converting towed units in the theater to self-propelled equipment. During November, the War Department confirmed that ETO's desires were 40 self-propelled battalions and 12 towed. Additionally, all towed units were to receive 90-mm guns.³⁵

In general, the combat troops were finding the self-propelled units to be more useful and effective than towed battalions. For example, in contrast to the mixed success of the 823d at Mortain, the 704th--fighting near Arracourt, France in September 1944--was able to deal heavy losses to the Germans with comparatively few casualties.

The 704th was attached to the 4th Armored Division almost

immediately after its arrival in France during July 1944 and accompanied that division through August and September. Like the 823d, the 704th soon found itself dispersed among the combat commands (roughly equivalent to regiments) of the divisions.³⁶ Unlike the 823d, the 704th was equipped with M-18's.³⁷ By 19 September 1944, C Company found itself with Combat Command A (CCA) west of Nancy, France. Two platoons manned an outpost line while the Third Platoon remained at the combat command headquarters.³⁸

Achieving surprise in thick fog, the Germans managed to hit CCA with a Panzer brigade that included 42 Panthers. Initially, one company of tanks took the brunt of the attack. The commander of CCA ordered the Third Platoon of C/704th to outpost a hill between CCA headquarters and the tank company. Unaware of the actual situation, the platoon leader, Lieutenant Edwin Leiper, raced off into the fog with his M-18's. Approaching the hill, Leiper suddenly spotted the muzzle of a German tank gun some 30 feet away. He gave the dispersal signal and his well-trained platoon quickly deployed and opened fire. Minutes later, five German tanks had been destroyed while only one M-18 had been damaged. Remaining on the hill until afternoon, the platoon destroyed 10 more tanks while losing 2 more M-18's.³⁹ The third platoon's losses, while destroying 15 German tanks, are in sharp contrast to those of the 823d TD Battalion on 7 August. In addition, the maneuverability of the M-18 played a major role in this action and in the remainder of the battle:

It was also generally agreed that the tank destroyer missions at ARRACOURT could not have been as well performed by

heavy tanks . . . in as much as the tank destroyers were able to utilize speed and maneuverability over rough and muddy terrain over which [heavy] tanks would have been unable to move.⁴⁰

In addition to superior performance while performing their primary mission, self-propelled tank destroyers proved to be generally more useful than towed weapons. One tank destroyer officer commented that:

. . . the appearance and knowledge that self-propelled tank destroyers were at hand was a major reason that the infantry attained success and victory. . . . The towed guns can be just as brave and thoroughly trained but they never give much "oomph" to the fighting doughboy when the "chips are really down."⁴¹

Despite the fact that the other arms generally held the tank destroyers with high regard, there were exceptions. Training and morale varied among tank destroyer battalions. Probably more important, the status of tank destroyers as an attached unit often meant that the companies and platoons suddenly found themselves joining an infantry or armored unit just prior to combat. Unfamiliarity bred mutual mistrust, sometimes with unfortunate consequences. One man who commanded an infantry regiment commented about the attached tank destroyers:

Company C, [number omitted] TD Battalion, was probably the most dependable attached unit which I commanded. It uniformly failed in all its assigned tasks! It possessed no fighting spirit whatsoever, and was happiest when well to the rear, or tagging along behind the tanks. It was useful on road-blocks and defensive situations, where they served to deter the enemy if he should see them.⁴²

Fortunately, that observer's comments were not typical.

The effort to convert towed battalions to self-propelled guns was still underway in December 1944. In general, units with

M-18's were new units equipped in the United States. The M-36's replaced either towed guns or M-10's. Excess M-10's were given to towed units as they became available. Some units were in the midst of conversion when the greatest challenge to tank destroyers began, the German attack of nearly 1,500 armored vehicles in the Ardennes in December 1944.

The American Army never had the opportunity to mass tank destroyers as advocated by FM 18-5 to meet the German attack. Unwarned by "Ultra," the American Army was completely surprised by the Germans.⁴³ The attack found American units spread thinly among the forests and ridges of the Ardennes, with tank destroyers dispersed among them.

Since the German formations involved in the attack included many armored vehicles, tank destroyers played a crucial role throughout the battle. But even after the Allies realized the scale of the attack, there was no attempt to concentrate tank destroyers into groups. The Battle of the Bulge was a confused, fluid action that found American command and control fragmented. Combat commanders, from army commanders to squad leaders, fought their own local battles with the means they found at hand. Dispersal of tank destroyers reflected the general confusion. However, as the Army's history of the battle points out, "The mobile, tactically agile, self-propelled, armored field artillery and tank destroyers are clearly traceable in the Ardennes fighting as over and over again influencing the course of battle."⁴⁴

While tank destroyers played an important and generally

successful role in stopping the German attack, the presence of large numbers of Panthers and Tigers accentuated the weakness of American firepower that had been revealed during the summer. The Commander of the 2d Infantry Division, in his first fight against a large force of tanks, asked for more 90-mm guns. As H. M. Cole points out in The Ardennes, the wish for:

. . . adequate armament to cope with the German Panthers and Tigers was being echoed and would be echoed—prayerfully and profanely—wherever the enemy panzer division appeared out of the Ardennes hills and forests.⁴⁵

The available M-36's proved to be a blessing. Often, the M-36 proved to be the only weapon capable of dealing effectively with the heavy, German tanks. For example, one narrative of the fighting near the Elsenborn Ridge relates the following incident:

Powers [Lieutenant Powers of the 740th Tank Battalion] slowly pushed on, having no idea what lay ahead. A second big tank loomed up. Before the German could fire, Powers sent a round into the Tiger's front slope plate. The shell bounced off harmlessly.

Powers' gun jammed. Since the radios were useless he hand-signalized the tank destroyer to move in. The Tiger, jarred by Powers' first shot, fired two wild rounds. Then the American tank destroyer's big 90-mm roared. The Tiger flamed.⁴⁶

The main problem with the M-36 at the Ardennes was its scarcity.

By 20 December, there were only 236 of the vehicles in the hands of troops.⁴⁷

In addition to creating more pressure for heavier antitank weapons, the fighting in the Ardennes completely discredited the towed guns of tank destroyer units. The towed guns' lack of mobility made them less effective than self-propelled guns and resulted in greater losses. Towed guns could not maneuver to obtain

the flank shots necessary to kill heavy, German tanks. In addition, they could not advance to support a counterattack and were almost inevitably lost when a retreat was necessary. For example, of 119 tank destroyers lost by the First Army in December, 86 were towed.⁴⁸ The veteran of Mortain, the 823d TD Battalion, contributed to those losses.

Still attached to the 30th Infantry Division of the First Army, the 823d was one of those units that was in the middle of conversion to self-propelled equipment when the Germans attacked. The battalion had begun to receive M-10's in early December and, by mid-month, had four per company. Hastily committed to battle on 17 December, the battalion's companies generally tried to use towed guns in forward positions and retain the M-10's as a mobile reserve. Typically, the 823d TD Battalion recorded that "Upon the withdrawal of friendly Infantry, TD guns were one by one flanked by enemy tanks and personnel driven from the guns by small arms and machine gun fire" Nine guns were lost in the foregoing incident.⁴⁹

By 29 December, General Holly wrote to the War Department that, "100% self-propelled T.D.'s now desired. Towed people are quiet these days."⁵⁰ As a result of losses in the Ardennes, ETO requested to convert all towed battalions to self-propelled equipment.⁵¹ The War Department approved the theater's request on 11 January 1945.⁵² Thus, towed guns, demanded as a result of combat experience, were abandoned as a result of combat experience.

Combat commanders still viewed the self-propelled tank

destroyers with esteem. The Third Army was so enthusiastic about the M-18's mobility that they referred to the vehicle as " . . . the finest piece of tracked equipment in the U.S. Army."⁵³ However, views concerning tank destroyers were not unanimous. While the Third Army preferred mobility, the First Army desired heavier armor instead of speed.⁵⁴

The desires for armor tended to prevail over desires for speed. As a result of requests from Europe, the Ordnance Department developed armored tops for tank destroyer turrets.⁵⁵ With the advent of armored tops, tank destroyers became more and more like tanks.

Probably more important for the fate of tank destroyers, the Army introduced a new tank, the M-26, with the 90-mm gun. Previously, one of the main advantages of tank destroyers had been that they had generally had a better gun than tanks. While the Sherman tank had been limited to the 75-mm gun, tank destroyers carried the 3-inch gun. As 76-mm guns began to appear in Sherman tanks, the M-36 with the 90-mm gun became available. The appearance of the M-26 meant that America's best antitank gun was now available in a tank. Increasingly, the tank destroyer was viewed as a hybrid tank.

After hostilities ended, the European Theater appointed a General Board to conduct studies to determine the lessons learned during the campaign in Europe and how those lessons should change doctrine and equipment in the Army. Among the recommendations was a proposal to increase organic, antitank firepower in the infantry

division and thus eliminate the need for attached tank destroyers. Antitank firepower in the infantry division could be increased by making tanks organic to the regiments. Noting the increased firepower of tanks, the board concluded that armored division had no requirement for tank destroyers. Therefore, the board recommended that the tank destroyer function should be assumed by tanks and "That the tank destroyers as a separate arm be discontinued."⁵⁶ Ultimately, the War Department agreed; and after World War II, the tank destroyers were abandoned.

Thus, despite their contribution to victory, the career of tank destroyers came to an end. The tactical situation had never allowed tank destroyer doctrine to be properly used. Throughout the campaign against Germany, tank destroyers tended to be used to substitute for or to supplement tanks. As the demand for heavier guns grew, those guns were mounted on tanks as well as on tank destroyers. Towed guns, unable to compete with tanks or self-propelled guns, were totally abandoned. Sadly, when the ideal tank destroyer, the M-18, on which General Bruce and others pinned such great hopes, actually appeared, it proved to be undergunned. Finally, after never receiving a fair test, tank destroyer doctrine was quickly forgotten.

ENDNOTES

¹The General Board, United States Forces, European Theater, "Report on Study of Organization, Equipment, and Tactical Employment of Tank Destroyer Units," Study Number 60, dtd. 22 April 1946, CGSC Library No. R-12885.60-2, p. 1, hereafter referred to as GB 60.

²Ibid.

³Memo from Brig. Gen. J. A. Holly, AFV & W Section, to G-3, ETOUSA, Records of the Armored Fighting Vehicles and Weapons Section, European Theater of Operations, RG 338, National Archives, hereafter referred to as ETO.

⁴Maj. Irl D. Brent, II, "Final Historical Report," ETO, p. 19, hereafter cited as Report, ETO.

⁵Cable from Eisenhower to War Department, dtd. 20 May 1944, AGF.

⁶Memo from Maj. Gen. S. G. Henry, Director, New Developments Division to Chief of Staff, U.S. Army, dtd. 17 April 1944, C/S.

⁷GB 60, p. 10.

⁸Ibid., p. 2.

⁹Ibid., p. 5.

¹⁰Ibid., p. 10.

¹¹Committee 24, Officers Advanced Course, The Armored School, Employment of Four Tank Destroyer Battalions in the ETO, Fort Knox, Kentucky, May 1950, pp. 83-84, hereafter cited as Employment.

¹²F. W. Winterbotham, The Ultra Secret (New York: Harper & Row, 1974), pp. 148-154.

¹³Employment, p. 85.

¹⁴After Action Report, 823d TD Battalion, RG 407, National Archives, 5 and 6 August 1944, hereafter cited as AAR, 823.

¹⁵Employment, pp. 86-88.

¹⁶Ibid., p. 86 and AAR, 823, 7 August 1944.

¹⁷Employment, pp. 94-95.

¹⁸Ibid., pp. 95-96.

¹⁹Robert L. Hewitt, Workhorse of the Western Front—The Story of the 30th Infantry Division, p. 54 quoted in Employment, p. 99.

²⁰AAR, 823, 7 August 1944.

²¹Ibid.

²²Employment, pp. 99-106.

²³First United States Army, "Report of Proceedings of Board of Officers," Report of Operations, 1 August 1944-22 February 1945, Annex 5, Appendix 2, pp. 65-66.

²⁴Eisenhower quoted by Omar N. Bradley, A Soldier's Story (New York: Popular Library, 1964 [originally 1951]), p. 322.

²⁵Alfred D. Chandler, Jr., gen. ed., The Papers of Dwight D. Eisenhower, 4 vols. (Baltimore: Johns Hopkins Press, 1970), Vol. 3: The War Years, pp. 1973-1974.

²⁶Disposition form from Maj. Gen. R. L. Maxwell, G-4, War Dept., to CG, ASF, dtd. 10 July 1944, G-4 Decimal file, file no. 473, RG 165, National Archives.

²⁷OGM, Item 20126, 22 March 1943.

²⁸Letter from Maj. Gen. A. C. Gillem, CG, Armd. Cmd., to CG, AGF, dtd. 4 September 1943, AGF (470.81).

²⁹Letter from Brig. Gen. John W. Coffey, Ord. Off., HQ, SOS, NATO to Col. James L. Guion, Off. of the Chief of Ord., dtd. 21 August 1944, OHF.

³⁰Memo from RQTS 1 to CG, dtd. 18 October 1943, AGF (470.8). Most contemporary sources specify that the Panther's hull front was 80-mm thick angled at 55°.

³¹Letter from Brig. Gen. J. Q. Holly to G-3, ETOUSA, op. cit. Although Holly emphasizes the Mark V he appends a chart showing penetration of U.S. guns against the Mark VI which, however, accurately shows that the 3-inch gun would not penetrate the front of the Tiger.

³²Memo from Capt. Irl D. Brent, II to Exec. Off., AFV&W Section, dtd. 24 May 1944, ETO.

- ³³Cable from Campbell to Eisenhower, dtd. 5 July 1944, OHF.
- ³⁴Final Report, ETO, App. G.
- ³⁵Letter from Maj. Gen. J. E. Hull, Asst. C/S to HQ, ETO, dtd. 16 November 1944, and Memo from Hull to G-4, dtd. 27 November 1944 with Memo for record, Records of the Operations and Plans Division (OPD), RG 165, file no. 472.1, National Archives.
- ³⁶Employment, p. 65.
- ³⁷Report No. 1095, "M-18 Helicat Tank Destroyer," dtd. 9 February 1945, Bruce.
- ³⁸Employment, pp. 66-70.
- ³⁹Ibid., pp. 71-76.
- ⁴⁰Ibid., p. 79.
- ⁴¹GB 60, p. 18.
- ⁴²Letter from HQ, AGF to CG's Replacement and School Cmd., Armored Center, and TD Center, undated (but sometime after August 1944), Folder 189, AGF Obs. The letter contains extracts of a report by Col. Clyde E. Steele who commanded a regiment of the 36th Inf. Div. in France.
- ⁴³Winterbotham, The Ultra Secret, p. 177.
- ⁴⁴Hugh M. Cole, The Ardennes: Battle of the Bulge (Washington, D.C.: OCMH, 1965), p. 653.
- ⁴⁵Ibid., p. 125.
- ⁴⁶John Toland, Battle: The Story of the Bulge (New York: Random House, 1959), p. 135.
- ⁴⁷Final Report, ETO, App. G.
- ⁴⁸First Army Report, Annex 4, p. 22.
- ⁴⁹823 AAR, 4 December, 10 December, 11 December, 17 December, and 19 December 1944.
- ⁵⁰Letter from Holly to Brig. Gen. W. A. Borden, New Developments Division, War Dept., dtd. 29 December 1944, G-4 decimal files, file no. 473, RG 165, National Archives.
- ⁵¹GB 60, p. 2.

⁵²Routing Slip, dtd. 3 March 1945, G-4 decimal files, op. cit., contains a reference to the message.

⁵³Third Army After Action Report, Part 24, "Tank Destroyer," Chapter 13, undated, CGSC Library No. N-11480-B.

⁵⁴Letter from HQ, 12 Army Group to CG, ETO, dtd. 9 November 1944, AGF (473).

⁵⁵M-36 Chron., 18 January 1945 and 5 April 1945.

⁵⁶QB 60, p. 29.

CONCLUSION

Spurred by the German conquest of France in 1940, the United States Army had developed a unique weapon, the tank destroyer, to defeat the instrument of Germany's success—massed armor. During the interval between the fall of France and America's entry into war, the Army created a concept of mobile antitank organizations specifically designed to meet the German threat. Primarily the brainchild of Major General Lesley J. McNair, the concept of tank destroyers encompassed tactical doctrine, organizations, and equipment. Each of those features had to be developed in a short time.

The doctrine created for tank destroyers by the first months of 1942 was a mixture of offense and defense. While the overall mission of tank destroyers was defensive, their tactics were aggressive. After locating an enemy armored force, tank destroyers were expected to move aggressively to mass their firepower against the enemy tanks.

Massed firepower was the cornerstone of tank destroyer doctrine. Their advocates never claimed that tank destroyers were superior to tanks in a one-to-one confrontation. Instead, using superior mobility, the tank destroyers were expected to mass predominant combat power at the time and place of their choosing. The Tank Destroyer Center provided group and brigade headquarters to enable the separate TD battalions to be massed. Perhaps the essence

of tank destroyer doctrine is best expressed by the motto of those units: Seek, Strike, Destroy.

The organization of tank destroyer battalions reflected their doctrine. Organic reconnaissance provided a capability to seek the enemy. Organic security assets were necessary since the battalions would operate behind the mass of friendly infantry. Tank Destroyer companies had heavy firepower to strike and ultimately destroy the enemy force. To do this, the guns of the companies needed superior mobility and this requirement forced the Tank Destroyer Center to become involved in the process of developing equipment, principally self-propelled guns. Unfortunately, development of equipment proved to be more time consuming than the writing of doctrine.

The technological problem of the Tank Destroyer Center was combining a heavy gun with a vehicle that could out-maneuver enemy tanks. Employing a twofold solution, the Tank Destroyer Center adapted the best equipment that was immediately available while starting the development of their desired weapon from scratch. Existing trucks and half-tracks were modified to carry 37-mm or 75-mm guns. Using available equipment, the first tank destroyers were inadequate expedients which the Tank Destroyer Center admitted could not fulfill tank destroyer doctrine. However, the exigencies of war forced the first tank destroyer battalions to enter combat with those expedients.

The experiences of the American Army in North Africa forced the Tank Destroyer Center to modify doctrine, organization, and

equipment. Dissatisfaction with existing tank destroyer units from commanders in the field, although those same commanders persistently misused tank destroyer units, forced the Center to adapt their organizations to accept towed guns. The Center had consistently held the view that towed guns did not have sufficient mobility to use tank destroyer doctrine. In addition, doctrine had to be modified to reflect the dispersal of tank destroyer battalions, such dispersal being the reality faced by tank destroyer units in combat. In addition to doctrinal changes, combat experience forced new efforts toward developing equipment. The inadequacies of the earliest tank destroyer weapons contributed to the general dissatisfaction with the units.

Not surprisingly, the hastily constructed M-3's and M-6's proved to be less than perfect when facing German tanks. General Bruce had recognized the weakness of those weapons from the start and had begun the development of the "ideal" tank destroyer, the M-18, in the first days of 1942. However, the normal problems of technological development kept the M-18 off the battlefield until 1944. Despite General Bruce's complaints about the recalcitrance of the Ordnance Department, the industry-ordnance team developed the M-18 in a remarkably short time, considering the technological innovations of that vehicle. The fact that 2 years was a short development period underlines the inherent, technological difficulties of producing military hardware.

One point demonstrated by the history of the M-18 is that it is possible to shorten the development process if waste is

acceptable. By rushing into production before the vehicle was standardized, the M-18 was made available for combat earlier than it otherwise would have been. If production of the M-18 had been delayed until the vehicle was standardized, its arrival on the battlefield probably would have been delayed by 6 months or more. However, the extensive modifications required by early production M-18's undoubtedly wasted funds. Such waste would probably have been unacceptable in peacetime. Despite the speed with which the M-18 was completed, the period was still not short enough to assuage General Bruce's discontent with the Ordnance Department.

General Bruce's dissatisfaction with the Ordnance Department was amplified by the M-10. The Tank Destroyer Center was not an independent organization, and its senior headquarters (AGF) agreed with the Ordnance Department and forced General Bruce to accept the M-10, which the latter regarded as another expedient. Despite General Bruce's complaints, however, the M-10 proved to be an effective weapon, popular with the troops.

Participation from AGF in the development of tank destroyer equipment was also evident in the efforts to complete a 90-mm anti-tank gun. Despite opposition from the Tank Destroyer Center, AGF pressed efforts to complete both towed and self-propelled 90-mm guns. The self-propelled version, the M-36, ultimately proved to be the best antitank weapon in the hands of troops during the bitter fighting in the Ardennes. On the other hand, the towed version's development was fraught with technical difficulties. Ultimately, the towed gun, the T-5E2, was completed just in time to be rejected

by the commanders in the field.

Developed and issued as a result of experience in North Africa, towed guns in tank destroyer units were abandoned as a result of experience in Europe. The effectiveness of towed antitank guns in the open terrain of North Africa could not be duplicated in the woods and hills of Europe. In addition, the relatively small guns used in the desert war had grown immensely heavier by 1944. Lack of mobility caused heavy losses of towed guns, with little success against German tanks. The experiences of tank destroyer units in North Africa and Europe were alike in that they were not employed according to their doctrine in either place.

Despite intentions to employ tank destroyers according to FM 18-5, the tactical situation after D-day quickly resulted in disregard for proper tank destroyer doctrine. Piecemeal commitment of German tanks caused tank destroyer units to be dispersed. Commanders proved to be unwilling or unable to concentrate tank destroyers on those occasions when massed German armor appeared. More disheartening, the guns of tank destroyer units, even those units with the M-18, proved wanting in the face of the Panthers and Tigers.

The failure of the US Army to properly assess the effectiveness of its antitank weapons against German tanks defies explanation. While the Ordnance Department must accept most of the guilt for this failure, the Tank Destroyer Center is certainly not blameless. It would seem that an organization dedicated to destroying enemy tanks would have left no stone unturned to assure that its weapons were

adequate for the task. In retrospect, the complacency of the Tank Destroyer Center with regard to the effectiveness of the 3-inch and 76-mm guns is astounding. Certainly, the inadequacies of the guns on tank destroyers were part of the reason that tank destroyers were abandoned, particularly since tanks proved capable of carrying the larger guns while being generally more useful than tank destroyers.

While the US Army disbanded its tank destroyer units, it is impossible to conclude that tank destroyers failed. Tank Destroyer doctrine was never really tested in combat. While the tactics of tank destroyer units at the company or battalion level proved to be successful when used, the basic concept of tank destroyers—mobile antitank formations operating in mass—was never employed. Thus, the doctrine of FM 18-5 was never given an opportunity to prove itself.

The primary reason that the concepts of FM 18-5 remained unproven was that the threat that those concepts were designed to meet did not exist by the time the American Army was heavily involved in combat. Despite the concern caused by the defeat of France, destroying enemy tanks was not the number one problem of the US Army during World War II. Tank destroyer doctrine was defensive, but from 1942 to 1945 the United States was almost continuously continuously conducting offensive operations. In defense of the commanders who misemployed tank destroyers, it must be pointed out that proper employment would have left a combat asset sitting idly in reserve most of the time. Of course, combat commanders are loath to

waste combat power, and therefore tank destroyers were frequently employed in missions other than antitank ones. Thus, tank destroyers were measured largely against their ability to substitute for tanks or artillery. The inadequacies of tank destroyers when compared to tanks was a major factor in the demise of the former.

The offensive character of the US Army's operations throughout most of the war often forced tanks to assume the role of tank destroyers. Instead of destroying attacking German tanks, the Army's greater problem proved to be the destruction of defending German tanks. American tanks were in the forefront of this battle, while the thinly armored tank destroyers had to support from the rear. Towed guns, of course, were almost useless against tanks during attacks and were effective only as supporting artillery.

Despite the relative inadequacy of a defensive organization (tank destroyers) in an army almost continuously on the offensive, the conclusion does not follow that creating the tank destroyers was a mistake. The presence of tank destroyers provided the Army with a large number of effective antitank guns—the 3-inch, 76-mm, and 90-mm—longer than those guns were available in tanks. Without tank destroyers, the Army's ability to deal with German tanks would have been much weaker. Although the tank destroyers were unable to prove all their concepts, they were a valuable asset to the American Army during World War II.

Even though tank destroyers were abandoned, their experience gave valuable lessons. Probably most important, combat developers should realize that it takes years to make drastic changes in

doctrine. In addition to the time required for the development of new equipment that may be required, a great deal of time is necessary to educate the Army about the capabilities and limitations of a new type of unit. Also, education must encourage the doubters to use the new unit according to the doctrine designed to insure that unit's success. Much of the misemployment of tank destroyer units was due to the fact that many commanders were ignorant of tank destroyer doctrine or disagreed with it.

Of course, the interval between the introduction of tank destroyer doctrine and the appearance of the equipment designed for that doctrine contributed to wartime dissatisfaction with tank destroyers. Tactical concepts can be written into doctrine much faster than weapons can be created.

Perhaps the important lesson that can be drawn from the difficulties encountered during the development of tank destroyer equipment is that the development of military equipment is not strictly the province of engineers and scientists. Conversely, technological realities can force the bureaucracy to change doctrine. Combat experience and the enemy's technological achievements impact directly on doctrine and development programs. The development of tank destroyers was constantly influenced by doctrine, bureaucratic politics, and combat experience.

Initially, development programs for tank destroyers were a direct result of new doctrine. In the case of tank destroyers, doctrine definitely drove technology and not the reverse. Tank destroyers were not created to take advantage of some dramatic

technological advance such as guided missiles. Indeed, the threat was not a strictly technical one. By 1940, virtually every army had solved the technical problem of destroying a tank. The new threat was a doctrinal change that massed tanks in large organizations. America's answer to the threat was a doctrinal response that massed antitank weapons into tank destroyer organizations, but the new doctrine demanded mobility not available from American antitank weapons of 1941. Doctrine had to be qualified to reflect the fact that technology initially could not provide the weapons desired by the Tank Destroyer Center. Consequently, the Tank Destroyer Center became heavily involved in the development of new equipment intended to meet doctrinal requirements.

Events quickly demonstrated that the Tank Destroyer Center would not dictate the course of its development programs. Institutional rivals with their own axes to grind, AGF and the Ordnance Department, proved capable and willing to alter development efforts. On some issues, the Tank Destroyer Center found itself completely overruled. In addition, overseas commanders, whose views were furbished with the credentials of combat experience, also influenced the development of tank destroyers.

Pressure from overseas involved the Tank Destroyer Center in the development of a new type of weapon, the towed gun. The Tank Destroyer Center had to modify both doctrine and organizations to incorporate the new weapon. Basic doctrine had to be modified to reflect the views from overseas. Significantly, overseas commanders did not demand heavier guns for tank destroyers despite their

experiences with heavy German tanks.

Within the American Army, the initiative for heavier guns came almost entirely from the Ordnance Department, with help from AGF. Reacting to the technological threat of heavy German tanks, development programs had to incorporate heavier weapons than those desired by the Tank Destroyer Center. However, the Ordnance Department failed to discover the true dimensions of the technological threat, and the rest of the Army gave them little impetus to improve in this area. The Army's failure to realize the technological problem posed by Germany's Tiger and Panther tanks makes this the saddest part of the record of the development of tank destroyers.

In conclusion, it is clear that the history of equipment development is not confined to the records of the technicians in factories, laboratories, or proving grounds. Technology is the metronome of development, governing its pace. However, doctrine, institutions, or experience can divert or stop the path of technological development.

APPENDIX

TECHNICAL DATA

This appendix is intended to provide the reader with a reference for the technical characteristics of various American antitank/tank guns and gun motor carriages (tank destroyers).

I. Guns.

37-mm. This gun was America's standard antitank gun at the beginning of the war and also equipped various tanks and armored cars.¹

Weight (M-3A1)	912 lb.
Projectile weight	1.92 lb.
Muzzle velocity	2900 fps.
Penetration (homogenous armor in mm angled at 30 degrees) at range (yards):	
0	65
500	57
1000	50
1500	43
2000	36

57-mm. This gun was an American version of the British 6-pounder antitank gun, and the two versions did not differ greatly.²

Weight (M-1A3)	3053 lb.
Projectile weight	6 lb. 4 3/4 oz.
Muzzle velocity	2800 fps.
Penetrations:	
0	100
500	84
1000	73
1500	60
2000	48

75-mm. This gun was used in the M-3. The towed version was not issued as an antitank weapon but the weight is listed for comparative purposes.³

Weight (M-1897A4)	3007 lb.
Projectile weight	14.92 lb.
Muzzle velocity	2050 fps.
Penetration:	
0	76
500	68
1000	60
1500	52
2000	47

3-inch. This gun equipped the M-10 and also existed in a towed version, the M-6.⁴

Weight (M-6)	5850 lb.
Projectile weight	15.43 lb.
Muzzle velocity	2600 fps.
Penetration:	
0	108
500	98
1000	90
1500	81
2000	74

76-mm. This gun equipped some Sherman tanks and the M-18. No towed version was mass produced. Projectile weight and ballistic data are the same as the 3-inch gun.

90-mm. This gun equipped the M-26 tank and M-36. A towed version also existed but did not become standard equipment.⁵

Weight (T-5M2)	7800 lb.
Projectile weight	23.56 lb.
Muzzle velocity	2600 fps.
Penetration:	
0	123
500	113
1000	104
1500	95
2000	87

II. Vehicles.

M-6, 37-mm Gun Motor Carriage. This was the 37-mm gun mounted on a 3/4 ton, 4 x 4 truck.⁶

Weight	3.28 tons
Speed	55 mph

Armor	1/4 inch (gunshield only)
Armament	37-mm gun

M-3, 75-mm Gun Motor Carriage. This was the 75-mm gun mounted in a half-track.

Weight	8.92 tons
Speed	45 mph
Armor	1/4 inch (front) 5/8 inch (sides)
Armament	75-mm gun

M-10, 3-inch Gun Motor Carriage. This was an adaptation of the Sherman tank's chassis.⁸

Weight	33 tons
Speed	30 mph (level) 20 mph (3 percent grade)
Armor	1/2—2 inches (hull front) 3/4—1 inch (hull sides) 2 1/2 inches (turret front) 1 inch (turret sides)
Armament	3-inch gun Cal. .50 Machine Gun (antiaircraft)

M-18, 76-mm Gun Motor Carriage. This was the carriage which the Tank Destroyer Center desired as the ideal tank destroyer.⁹

Weight	20 tons
Speed	50 mph (level) 15 mph (10 percent grade)
Armor	1/2 inch (hull front and sides) 3/4—1 inch (turret front) 1/2 inch (turret sides)
Armament	76-mm gun Cal. .50 Machine Gun (antiaircraft)

M-36, 90-mm Gun Motor Carriage. This was the M-10 modified to carry the 90-mm gun.¹⁰

Weight	31 tons
Speed	30 mph (level) 12 mph (10 percent grade)
Armor	1 1/2—2 inches (hull front) 3/4—1 1/2 inches (hull sides) 3 inches (turret front) 1 1/4 inches (turret side)
Armament	90-mm gun Cal. .50 Machine Gun (antiaircraft)

ENDNOTES

¹Peter Chamberlain and Terry Gander, Antitank Weapons: WW 2 Fact Files (New York: Arco Publishing Co., 1974), p. 47 and Table appended to "Agenda, Tank and Tank Destroyer Conference, Army War College," dtd. 26 January 1945, AGF (470.8), hereafter cited as Data. The table of ballistic performance notes is based on Inclosure 1, Military Attache Report No. 2473-44. The data is from firing tests in England and penetrations are based on fifty percent success against homogenous armor. In addition, the table contains the precaution that, due to variables in quality of plates, production shot, and errors in range estimation, the perforation thicknesses should not be interpreted as being exact.

²Data and Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. II: Artillery and Aircraft Armament, dtd. 1 October 1944, p. 167, hereafter cited as Ord. Cat. II. Data lists six different rounds for the British 6-pounder but none for the American 57-mm although their ammunition was apparently interchangeable. Ord. Cat. II states that the muzzle velocity of the 57-mm gun was 2700 fps. and penetration of homogenous armor angled at 20 degrees was as follows:

500 yd.	3.4 in.
1000 yd.	2.7 in.
1500 yd.	1.9 in.

³Data and Ord. Cat. II, p. 158. The penetration data mentions the 75-mm tank gun. The reader is asked to accept the resulting, small error in penetration, as it would apply to the M-1897A4 gun (MV-2000 fps.), in order to be able to compare penetration data from a single source.

⁴Data and Ord. Cat. II, p. 169.

⁵Data and E. D. Stahr, ed., Artillery, an unpublished manuscript in OHF, National Archives. The muzzle velocity listed is from Data but some sources give the muzzle velocity as 2650 fps.

⁶Peter Chamberlain and Terry Gander, Self-Propelled Anti-tank and Anti-aircraft Guns: WW 2 Fact Files (New York: Arco Publishing Company, 1975), p. 50.

⁷Ibid., p. 51.

⁸Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Vol. I: Tank and Automotive,

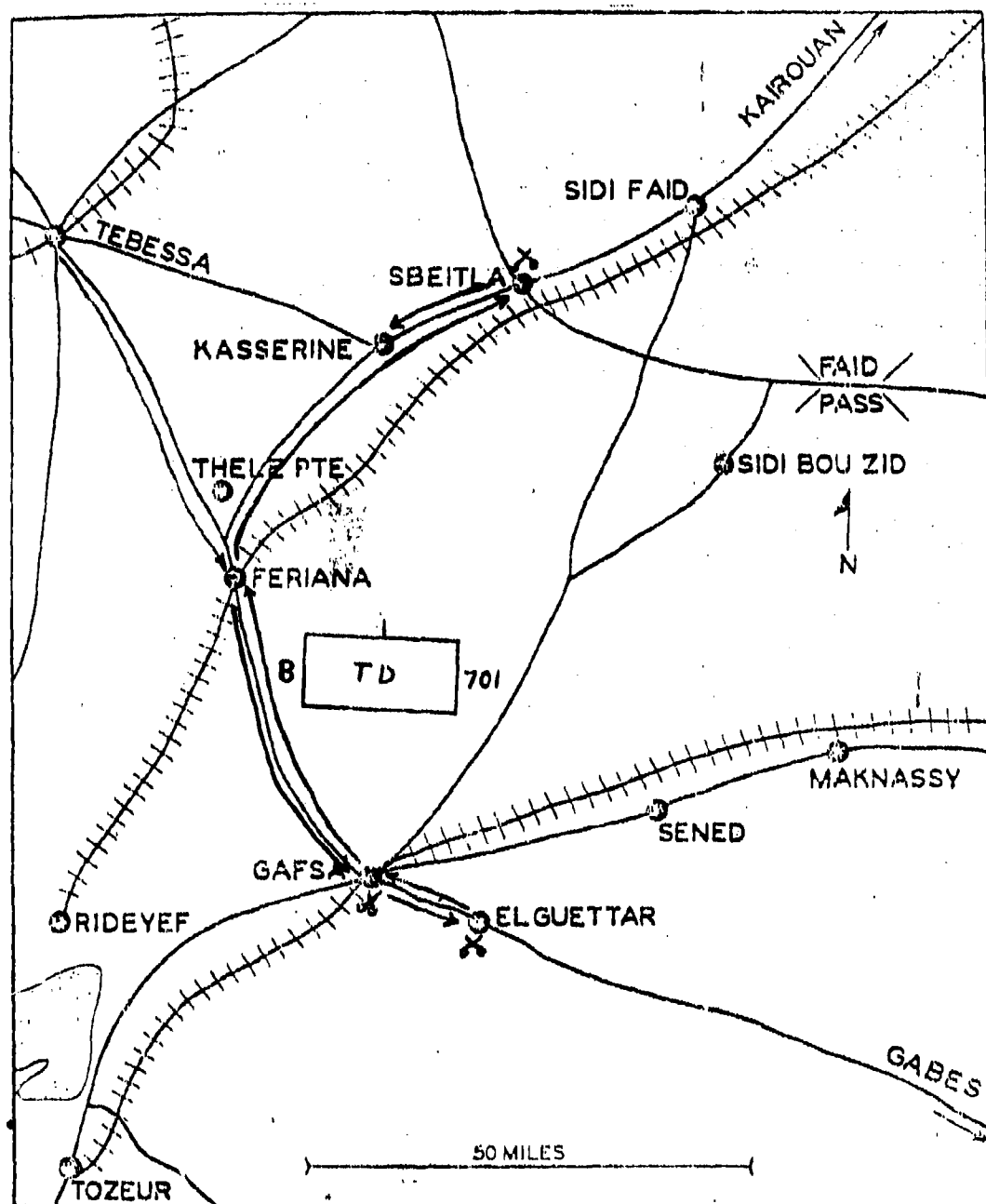
dtd. 1 December 1944, p. 42.

⁹ibid., p. 49.

¹⁰ibid., p. 51.

MAPS

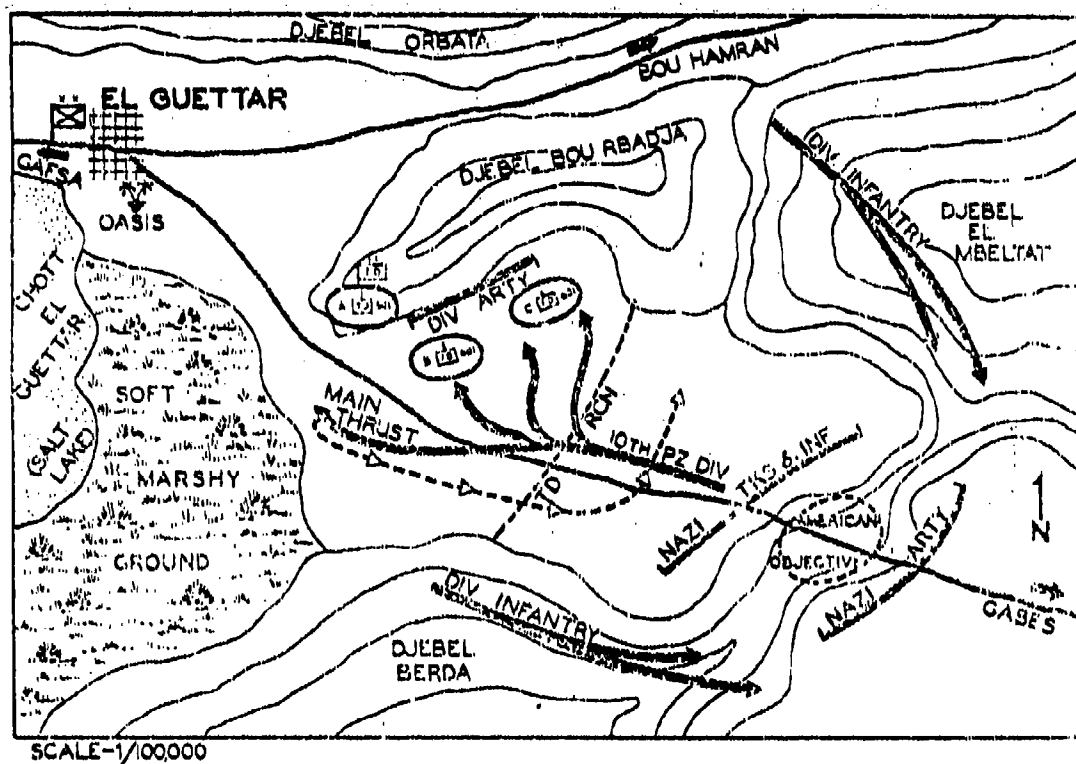
Map 1



CENTRAL TUNISIA

Map from Captain Gilbert A. Ellman, "Gafsa and Sbeitla,"
TD Combat in Tunisia, dtd. January 1944, Bruce, p. 3.

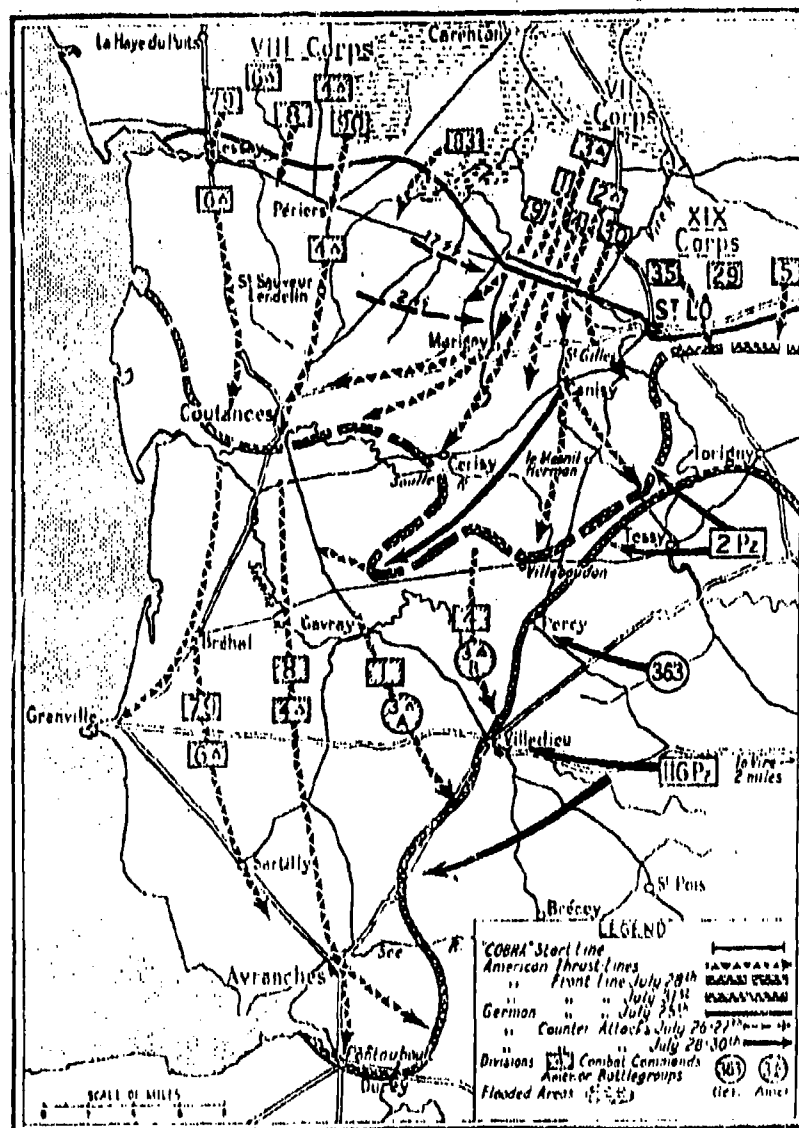
Map 2



EL GUETTAR

Map from Lieutenant Colonel H. D. Baker, CO, 601st TD Battalion, "El Guettar," TD Combat in Tunisia, dtd. January 1944, Bruce, p. 18.

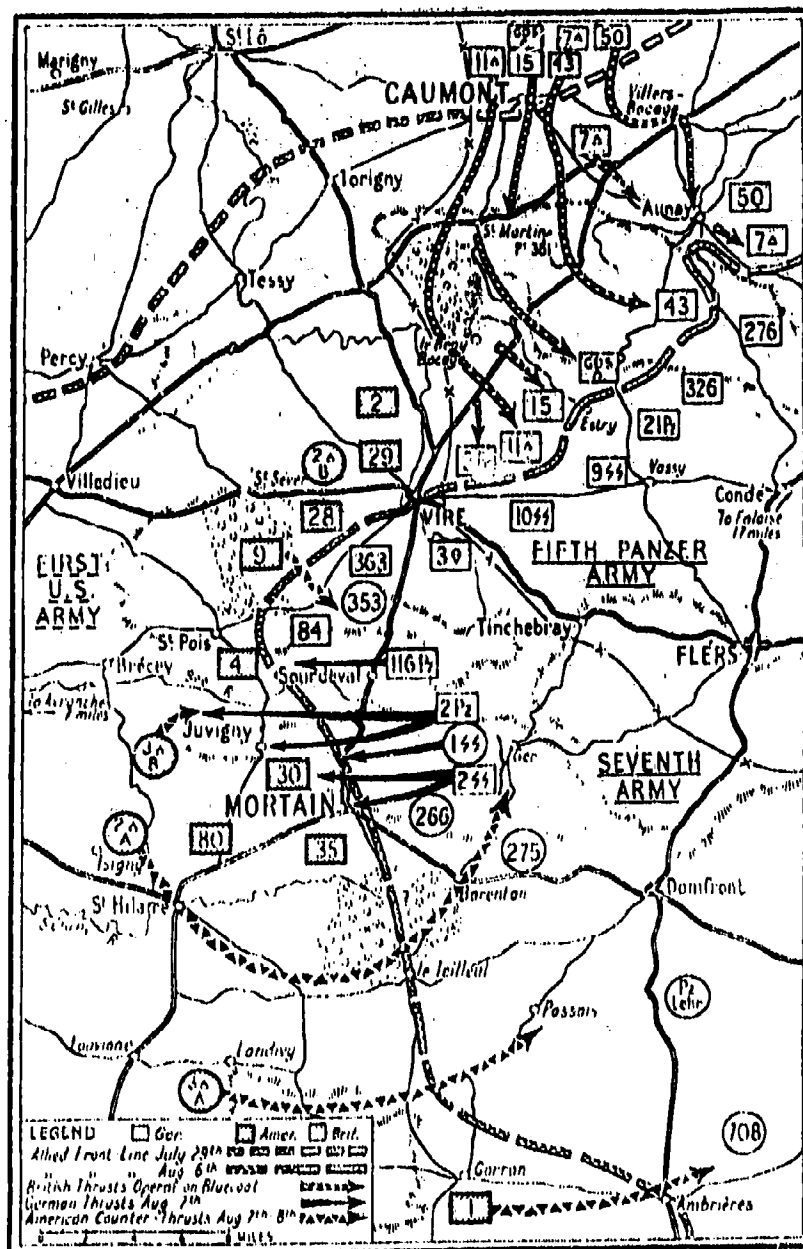
Map 3



OPERATION COBRA, JULY 25TH-31ST

Map from Chester Wilmot, The Struggle for Europe (New York: Harper & Brothers, 1952), facing page 384.

Map 4



THE MORTAIN COUNTER-ATTACK, AUGUST 7TH-8TH

Map from Chester Wilmot, The Struggle for Europe (New York: Harper & Brothers, 1952), facing page 385.

BIBLIOGRAPHY

BIBLIOGRAPHY

NATIONAL ARCHIVES

US War Department. After Action Reports, 823d Tank Destroyer Battalion. RG 407. National Archives.

_____. Memo from Maj. Gen. J. P. Lucas to the Commander-in-Chief. 26 August 1943. RG 407. AG File Number 370.2. National Archives.

_____. Minutes of the Ordnance Technical Committee. RG 156. National Archives.

_____. Records of the Armored Fighting Vehicles and Weapons Section, European Theater of Operations. RG 338. National Archives.

_____. Records of Army Ground Forces. RG 337. National Archives.

_____. Records of the Army Staff. G4 Decimal File. RG 165. National Archives.

_____. Records of the Army Staff. Operations and Plans Division. RG 165. National Archives.

_____. Records of the Chief of Staff, US Army. RG 165. National Archives.

_____. Records of Research and Development. Ordnance Historical Files. RG 156. National Archives.

GOVERNMENT SOURCES

The Command and General Staff School. Antimechanized Defense (Tentative). Fort Leavenworth, Kansas: The Command and General Staff School Press, 1939.

Committee 24, Officers Advanced Course, The Armored School. Employment of Four Tank Destroyer Battalions in the ETO. Fort Knox, Kentucky: The Armored School, May 1950.

Dunham, Lt. Col. Emory A. Tank Destroyer History, Study Number 29. Historical Section--Army Ground Forces, 1946.

First United States Army. Report of Operations, 1 August 1944--22 February 1945.

The General Board, United States Forces, European Theater. Report on Study of Organization, Equipment, and Tactical Employment of Tank Destroyer Units, Study Number 60. 22 April 1946.

McCaskey, Maj. D. L. The Role of Army Ground Forces in the Development of Equipment, Study Number 34. Historical Section, Army Ground Forces, 1946.

Office of the Chief of Ordnance, Technical Division. Catalogue of Standard Ordnance Items. Washington, D.C., 1945.

Palmer, Robert R. Reorganization of Ground Troops for Combat, Study Number 8. Historical Section, Army Ground Forces, 1946.

Third United States Army. After Action Report. Part 24. "Tank Destroyers." undated. Command and General Staff College Library, Fort Leavenworth, Kansas.

US War Department. Organization and Tactics of Tank Destroyer Units. FM 18-5. June 16, 1942.

_____. Tactical Employment: Tank Destroyer Unit. FM 18-5. 18 July 1944.

BOOKS

Bradley, Omar N. A Soldier's Story. New York: Popular Library, 1964 (originally 1951).

Chamberlain, Peter and Terry Gander. Anti-Tank Weapons: WW2 Fact Files. New York: Arco Publishing Co., 1974.

_____. Self-Propelled Anti-Tank and Anti-Aircraft Guns. New York: Arco Publishing Co., 1975.

Chandler, Alfred D., Jr., gen. ed. The Papers of Dwight David Eisenhower. 4 vols. Baltimore: Johns Hopkins Press, 1970, Vol. 3: The War Years.

Cole, Hugh M. The Ardennes: Battle of the Bulge. Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1965.

Davies, W. J. K. German Army Handbook. New York: Arco Publishing

Co., 1974.

Ellis, Lionel F. Victory in the West. London: H. M. Stationery Office, 1962.

. The War in France and Flanders. London: H. M. Stationery Office, 1953.

Greenfield, Kent Roberts, Robert H. Palmer, and Bell I. Wiley. The Organization of Ground Combat Troops. Washington, D.C.: Historical Division, Department of the Army, 1947.

Howe, George F. Northwest Africa: Seizing the Initiative in the West. Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1957.

Patton, George S., Jr. War As I Knew It. Boston: Houghton Mifflin Co., 1947.

Toland, John. Battle: The Story of the Bulge. New York: Random House, 1959.

Vilfroy, Daniel. War in the West. Harrisburg, Pennsylvania: Military Service Publishing Co., 1942.

Weeks, John. Men Against Tanks. New York: Mason/Charter, 1975.

Wilmot, Chester. The Struggle for Europe. New York: Harper & Row, 1952.

Winterbotham, F. W. The Ultra Secret. New York: Harper & Row, 1974.

OTHER SOURCES

Andrew D. Bruce Papers. Archives, US Army Military History Research Collection, Army War College, Carlisle Barracks, Pennsylvania.

Doughty, Robert A. French Antitank Doctrine, 1940: The Antidote that Failed. Unpublished manuscript in possession of the author.